THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXIV. No. 1645.] LONDON, NOVEMBER 20, 1894. [46TH YEAR. PRICE 6d.

JAMES OAKES & Co.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road,
CITY ROAD, LONDON, N.,
Manufacture and keep in Stock at their Works (also large stock in London)
PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

WOLSTON'S TORBAY PAINTS
Special Quotations to Gas Companies.
DARTMOUTH, DEVON.

Lanemark Coal Co.,
LIMITED.
LANEMARK CANNEL AND GAS COALS.
Quotations and Analysis on application to
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NEW CUMNOCK, N.B.
Shipping Ports: All the principal Scotch Ports.

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Parker's Imperial Black Varnish,
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Ashmore, Benson, Pease, & Co., Ld.,
STOCKTON-ON-TEES,
Manufacturing Gas Engineers.
See Advt. p. 997 of this week's issue.

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"ABYSSINIAN" & ARTESIAN TUBE WELLS,
FOR TOWN WATER-WORKS AND OTHER SUPPLIES.
The following Town Water-Works Supplies have been obtained by this System, viz.:—Abbott's Langley, Aldershot, Alnwick, Cirencester, Hertford, Lechlade, St. Albans, Shrewsbury, Skegness, Southampton, Stony Stratford, Swansea, Wallingford, Watford, West Worthing, Wimborne, &c.
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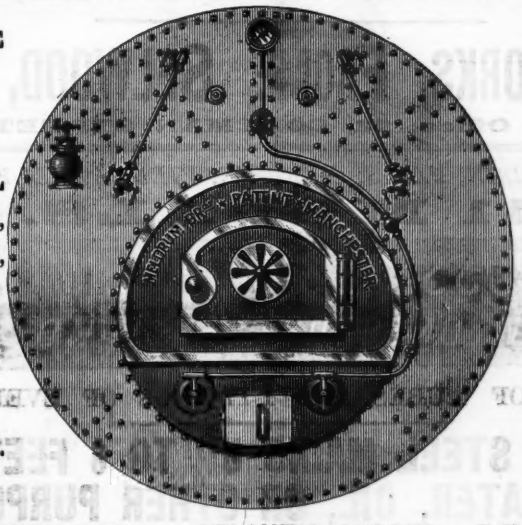
SUPPLIED to the PRINCIPAL GAS-WORKS, WATER-WORKS, ELECTRIC LIGHT STATIONS, &c., &c.



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PURIFIERS, CONDENSERS, SCRUBBERS, HYDRAULIC MAINS, and all kinds of GAS APPARATUS,

Wrought-Iron Roofs, Bridges, Girders, &c.,

Steam, Hot Water, and Range Boilers, Tanks, Cisterns, Boats, and all kinds of Wrought-Iron Work.

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The Washer is entirely automatic in its action, and does not therefore need any motive power—an advantage which will be apparent to all.

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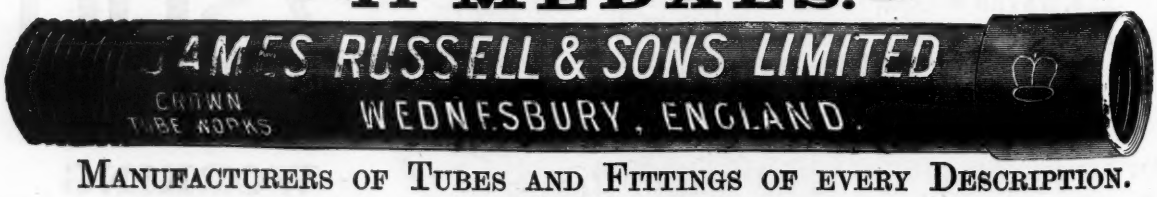

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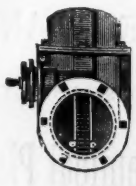
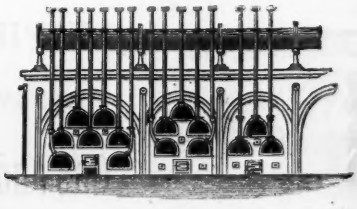
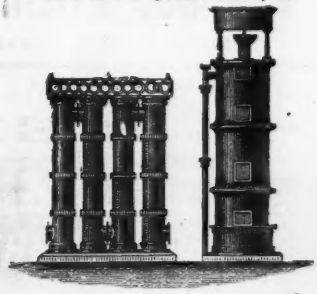
CENTRE-VALVES

for working Purifiers,

Also Bye-Pass & Stop Valves







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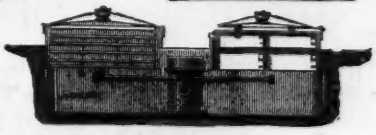

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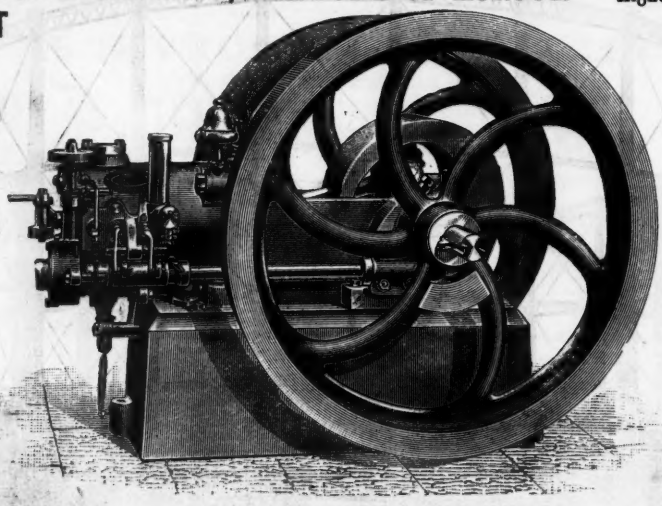

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Every Engine thoroughly tested before being sent out

ALL PARTS MADE STRICTLY TO GAUGE

GREAT REDUCTION IN PRICES.

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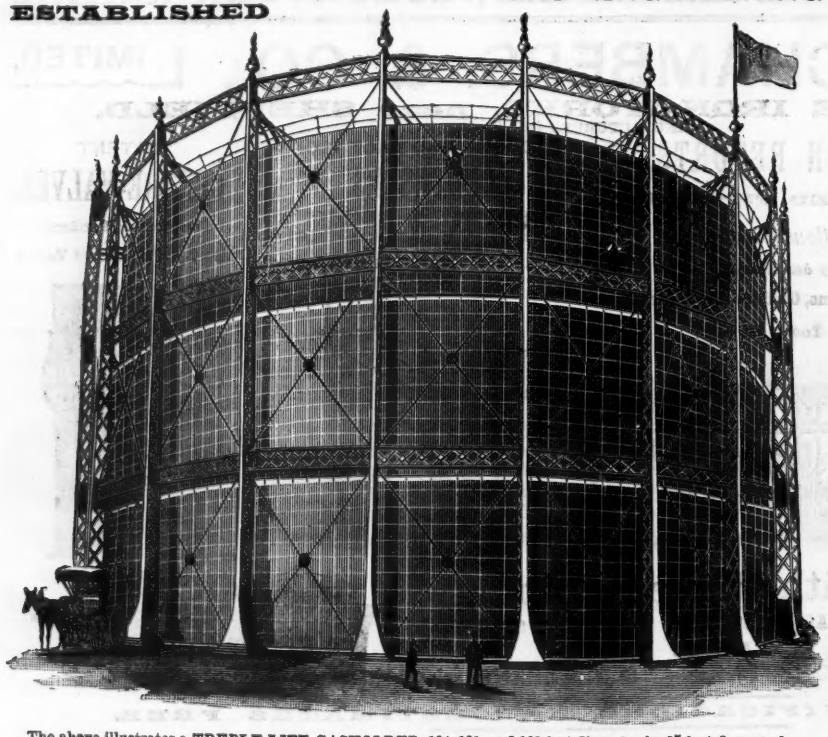

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PURIFIERS,

SULPHATE PLANTS,

AND EVERY DESCRIPTION OF

Gas and Chemical Plant.

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The Gasholder sheets are levelled by machinery, and are afterwards sheared, squared, and punched by an Improved Combined Multiple Punch and Shearing Machine, which also punches the circumferential seams of crown sheets by special punches and dies, ensuring perfect accuracy, avoiding rimering in erection.

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PURIFIERS with Planed Joints.

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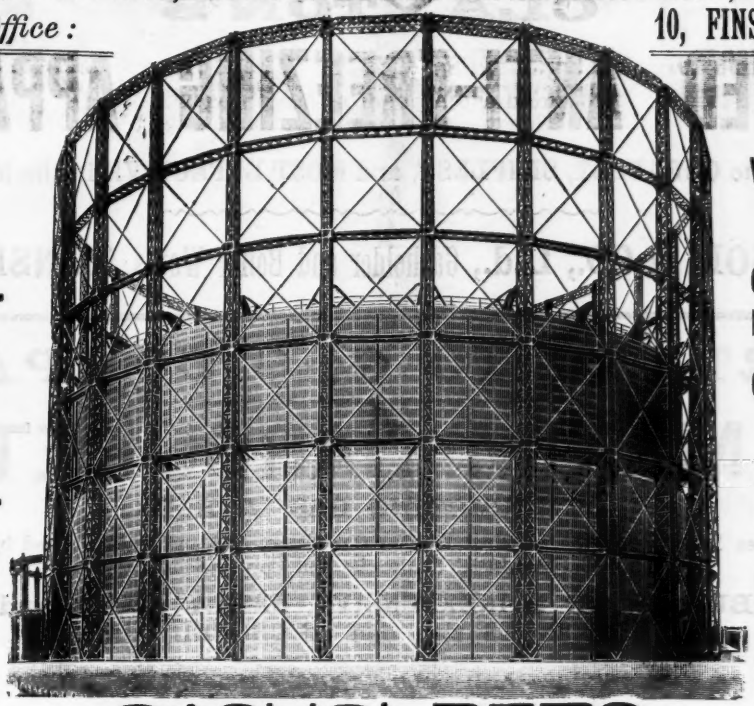
PURIFYING-MACHINES FOR AMMONIA.

CONDENSERS.

TAR PLANT.

SULPHATE OF AMMONIA PLANT.



GASHOLDERS.

WASHERS.

WASHER-SCRUBBERS.

CLAUS' SULPHUR-RECOVERY PLANT.

CENTRE & FOUR-WAY VALVES.

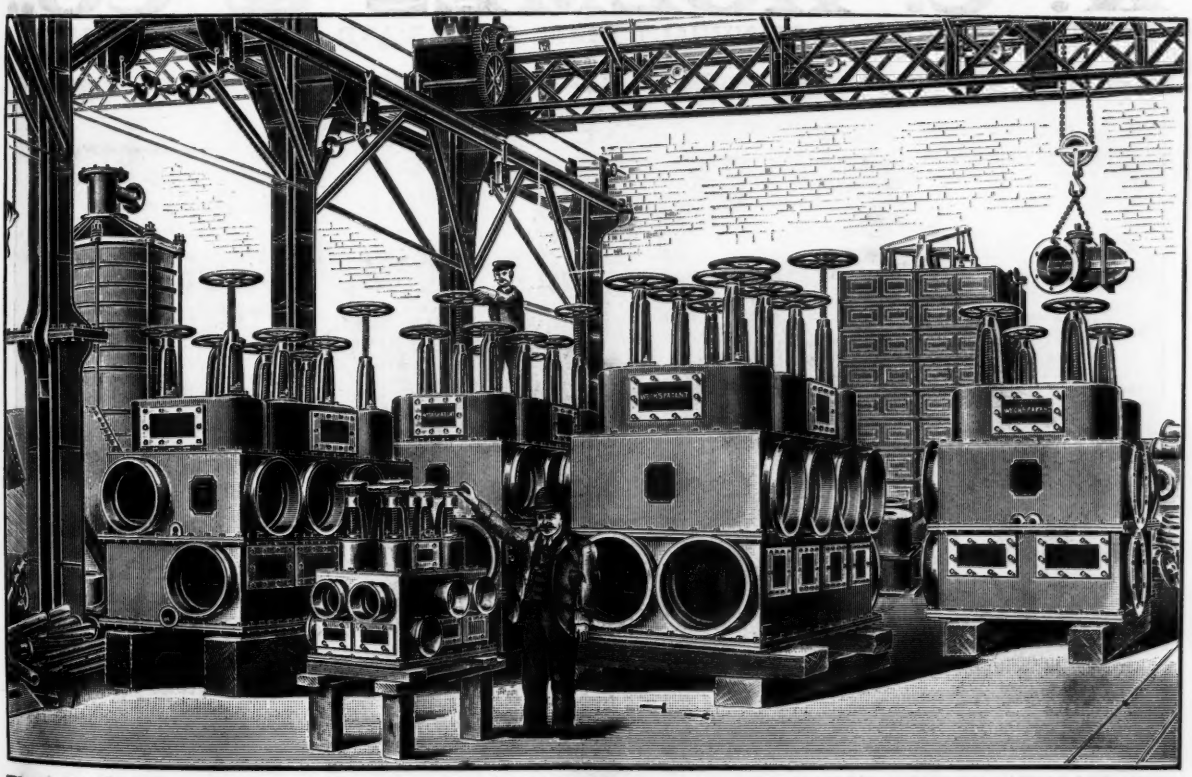
CRIPPS' HYDRAULIC MAIN VALVE.

RETORT-MOUTHPIECES.

SLIDE-VALVES, TAR-BURNERS, SIEVES.

The above is a view of the largest Gasholder (four-lift) of The Gaslight and Coke Company, Beckton, containing 8 million cubic feet, erected by us in 1892.

WECK'S PATENT CENTRE-VALVE.



The above is a copy of a Photo. of two out of Four 24-inch Eight-Way Valves for Belfast, one 24-inch Four-Way for Manchester, one 20-inch Eight-Way for Harrogate, one 6-inch Six-Way for Sheffield. These Valves were Photographed before being dispatched from our Works.

Sole Makers: C. & W. WALKER.

PREVENT YOUR GASHOLDER CUPS FROM FREEZING

BY USING

CLAYTON'S

IMPROVED ANTI-FREEZING APPARATUS

It is the CHEAPEST, SIMPLEST, and MOST EFFECTIVE in the Market.

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IMPORTANT TO GAS COMPANIES.

THE MAXIM CARBURETTOR,

FOR ENRICHING GAS IN BULK.

Used for the last Three Years by all the principal London Gas Companies, and since adopted by numerous Suburban and Provincial Companies and Corporations.

THE CARBURETTOR is INEXPENSIVE, EASILY FIXED, and ENTIRELY SUPERSEDES the use of CANNEL COAL.

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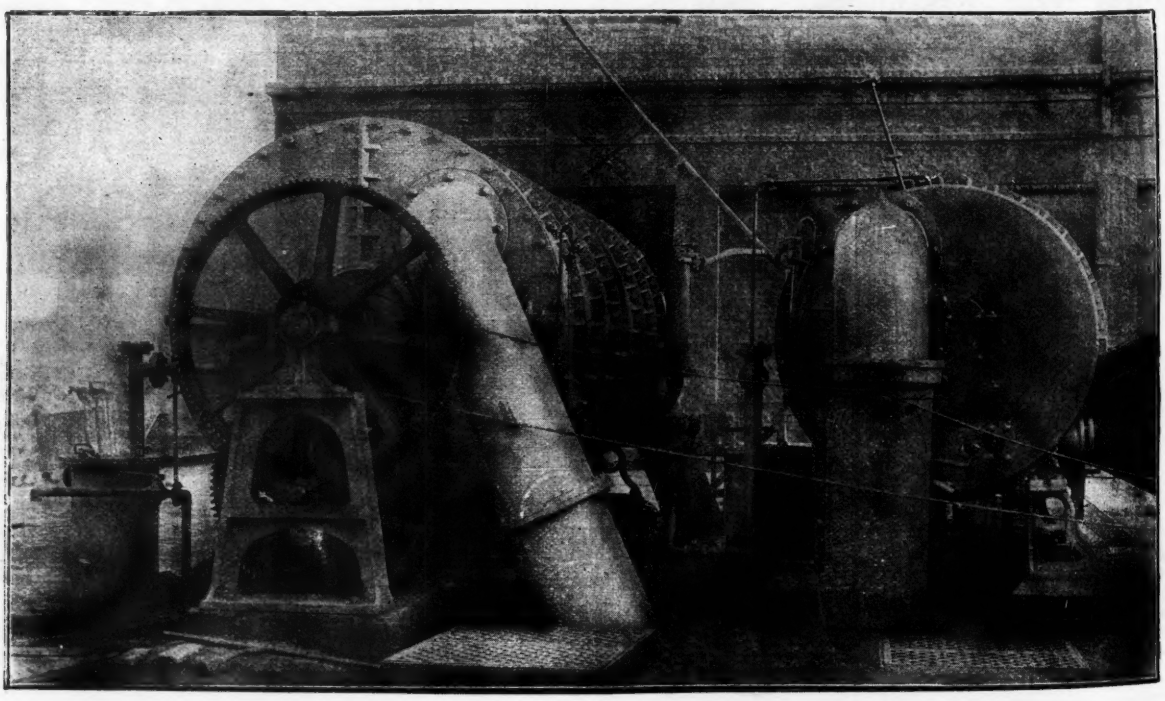
W. C. HOLMES & CO.,

CONTRACTORS, AND MANUFACTURERS OF GAS AND CHEMICAL PLANT.



IMPROVED PATENT SCRUBBER-WASHER as erected for the Corporation of Glasgow, and many other Corporations, Gas Companies, &c.

These **Washers** are guaranteed to present **a larger area of wetted surface** (size for size) to the action of the Gas than those of any other maker. **Results are unapproached by any other system.** References and full Particulars on application.

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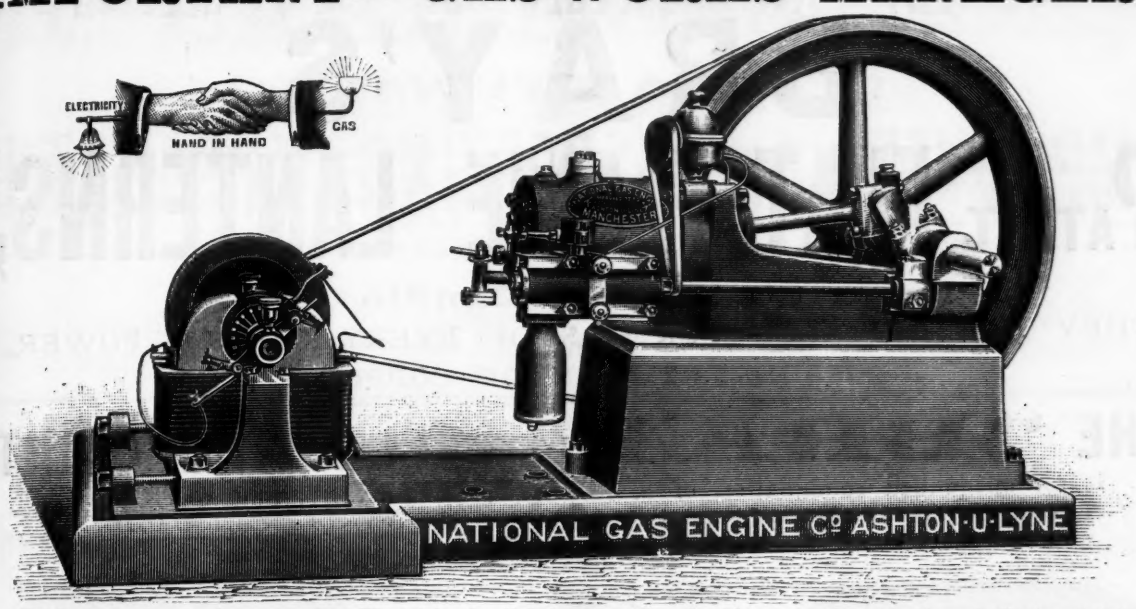
IMPORTANT TO GAS-WORKS MANAGERS



The fast growing tendency to adopt Electricity for lighting purposes should engage the attention of all thoughtful Gas Works Managers and those interested in Gas Companies.

By the aid of the Gas-Engine driving the Dynamo, **50 PER CENT. MORE LIGHT CAN BE OBTAINED FROM THE SAME GAS;** and thus, by their adoption as the motive power, the gas consumption of the district can be maintained and the light increased.

The **NATIONAL GAS-ENGINE** is specially constructed for this purpose, both for Small Installations for isolated places, and also for large Central Electric Light Station Work.

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THE NATIONAL GAS-ENGINE CO.,

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District Agents Wanted.

TO GAS COMPANIES, CORPORATIONS, AND VESTRIES.

IMPROVED STREET LIGHTING

WITHOUT ADDITIONAL COST,

With THREE to FOUR TIMES the ORDINARY LIGHT,

CAN BE OBTAINED BY

THE INCANDESCENT GAS-LIGHT (Welsbach System)

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From 30 to 1100 Candle Power.

THEY ARE SUITABLE FOR GAS OF EVERY CANDLE POWER,

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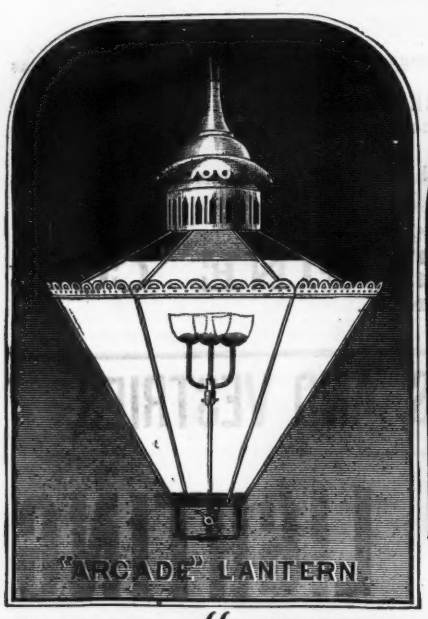
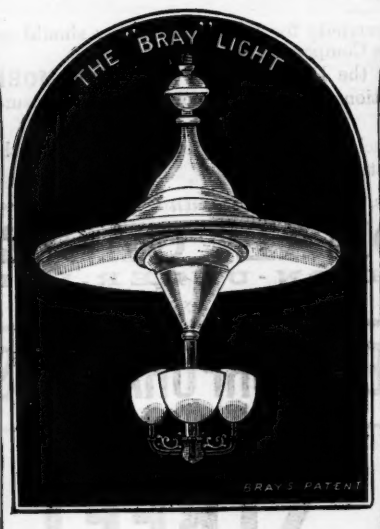
THE "BRAY" REFLECTING LIGHT

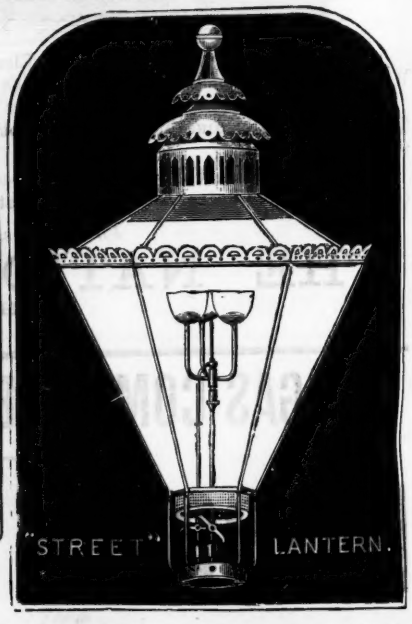
Is an unequalled combination of SIMPLICITY, CHEAPNESS, and EFFICIENCY.

GIVES REMARKABLE LIGHTING VALUE FOR GAS CONSUMED.

SEND FOR PRICES AND PARTICULARS.







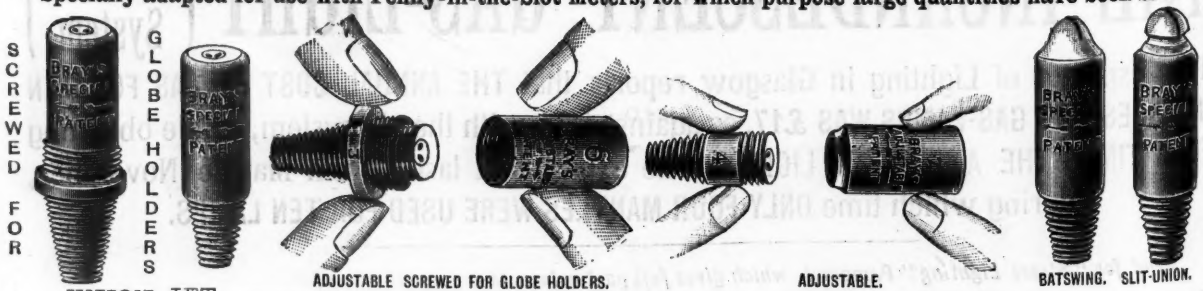
BRAY'S "SPECIAL" AND "ADJUSTABLE" BURNERS

Are the best in the Market for general use, and are very moderate in price.

It is not unusual to see the ordinary Burner yielding less than half the light that Bray's "Specials" and "Adjustables" would yield with the same consumption of Gas.

Gas Managers should try them on Consumers' Fittings; and they would see at once how to compete more effectively with the Electric Light.

Specially adapted for use with Penny-in-the-Slot Meters, for which purpose large quantities have been sold.



SEND FOR PRICES AND PARTICULARS.

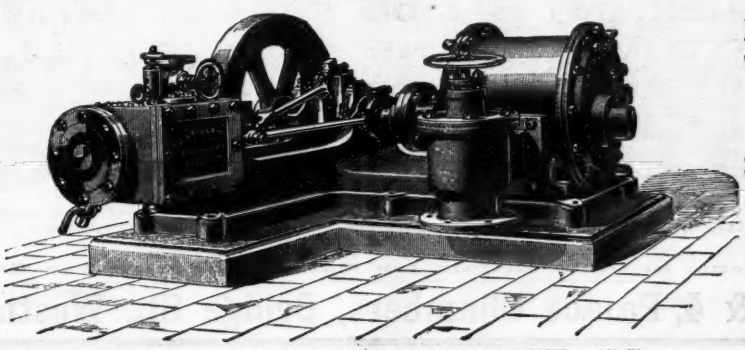
GEO. BRAY & CO., GAS LIGHTING ENGINEERS, LEEDS.

R. LAIDLAW & SON,

GAS AND WATER ENGINEERS.

Manufacturers of **GAS APPARATUS** of every Description.

Makers in Glasgow of
CAST-IRON PIPES, ALL SIZES,
LAMP PILLARS,
STEAM-ENGINES AND BOILERS,
PUMPING-ENGINES For Water-Works.
BEALE'S GAS EXHAUSTERS,
DOUBLE-FACED SLUICE VALVES, INTERNAL AND EXTERNAL
RACK OR SCREW SLIDE VALVES,
CAST-IRON COLUMNS, BEAMS, GIRDERS, AND WATER-TANKS,
WROUGHT-IRON TUBES, FITTINGS, &c.



BEALE'S GAS EXHAUSTER AND ENGINE COMBINED. All Sizes.

Makers in Edinburgh of
WET AND DRY GAS-METERS, IMPROVED
STATION GOVERNORS,
PRESSURE REGISTERS
PRESSURE GAUGES,
TEST HOLDERS,
EXPERIMENTAL HOURLY-RATE METERS, TEST METERS,
CONDENSER THERMOMETERS,
SIEMENS' WATER-METERS,
STREET LANTERNS, AND ALL KINDS OF
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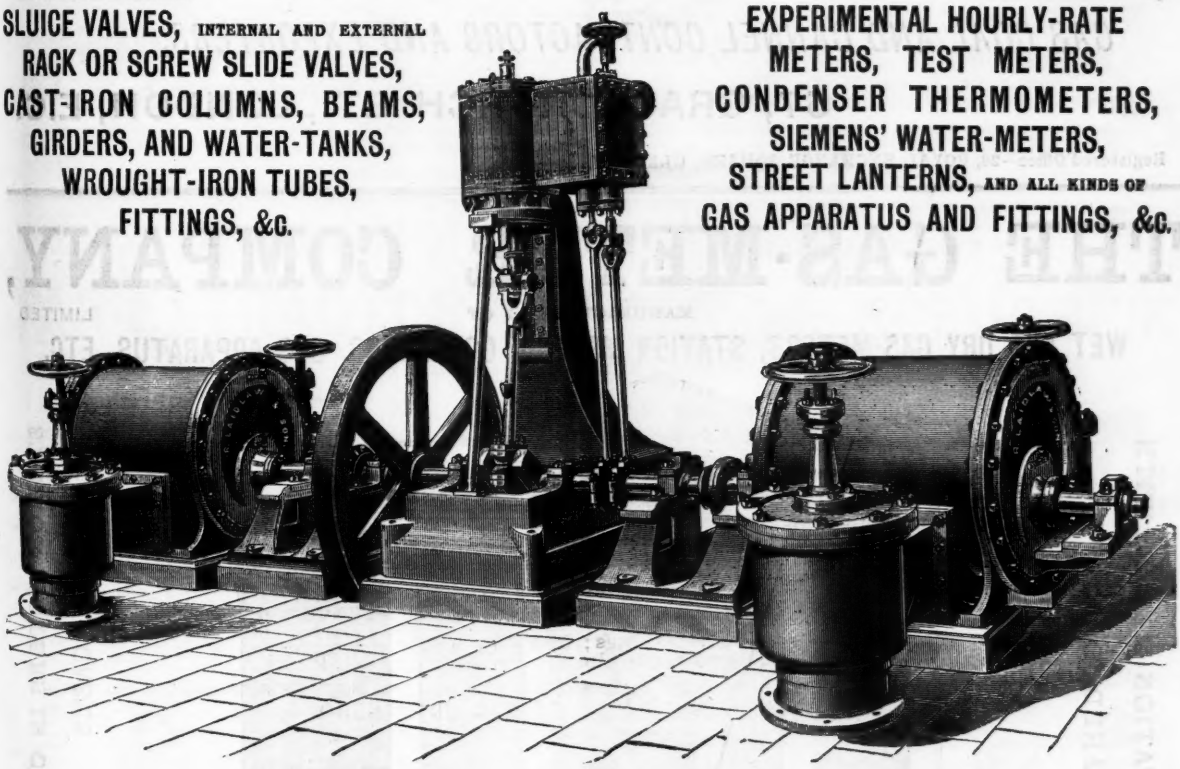

BEALE'S GAS EXHAUSTERS AND ENGINE COMBINED. All Sizes.

Prices, with full Particulars, will be given on application.

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INTERNATIONAL EXHIBITION, EDINBURGH 1886.

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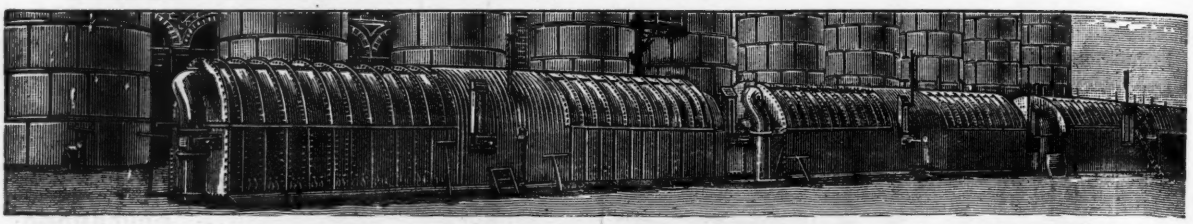
PATENT "STANDARD" WASHER-SCRUBBER

☛ **484** of these Machines (capable of dealing with **464,490,000** cubic feet of Gas daily) in use, which fact is given as evidence of this apparatus being the Most Efficient of any in the Market for the extraction of Ammonia, Carbonic Acid, and Sulphuretted Hydrogen from Coal Gas.



View of SIX PATENT "STANDARD" WASHER-SCRUBBERS, erected at the Beckton Station of The Gaslight and Coke Company (the Engines driving same being under Galvanized Iron Covers). This Company have **30** of these Machines in use. They are also in operation at a great number of Gas and other Works in this Country and Abroad.

Sole Agents in Great Britain for Marshall's Patent Tar Extractor.

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SQUARE STATION METERS WITH PLANED JOINTS.

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DESIGN No. 2 PATTERN.

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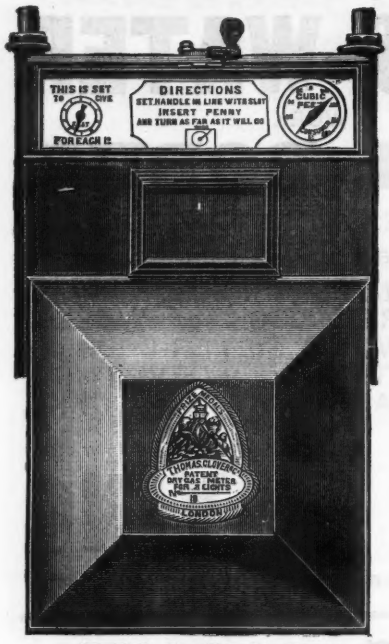

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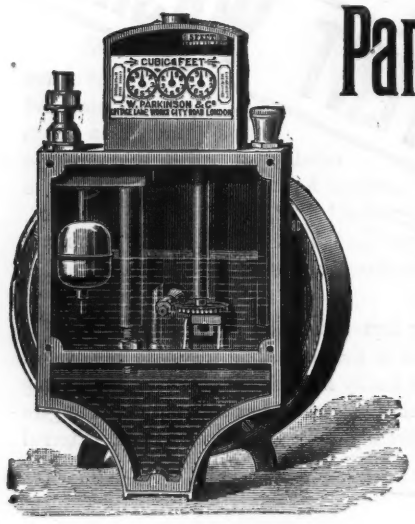

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TO CORRESPONDENTS.

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, NOVEMBER 20, 1894.

Unaccounted-for Gas.

THE subject of unaccounted-for gas possesses perpetual interest for gas managers; and, notwithstanding the amount of discussion that has been expended upon it from time to time since the adoption of the more accurate term in place of the older name of "leakage," it cannot be said that any marked progress has been made towards the complete comprehension of the different ideas embraced under this common designation. Mr. Lewis T. Wright has long since identified himself with a suggested reform of the usual method of stating the proportion of unaccounted-for gas to total production; and his further contribution to the literature of the subject which appeared in our issue for the 30th ult., is to be welcomed, not only on its own account, but also for its evidence that the writer has not dropped his studies of this problem. Mr. Frank Livesey's letter and diagram, which will be found in another column, form a most useful supplement to Mr. Wright's observations and speculations. It is impossible to have too many records of actual facts capable of serving as reliable data for disquisitions upon this class of subjects. Unaccounted-for gas interests the general public as well as gas managers, as may be seen by the letters which occasionally appear in the newspapers when the accounts of a gas undertaking have been published in detail. The ingenious outsiders who puzzle themselves over the figures relating to this constant element of such accounts usually interpret the term to mean leakage, for which they regard it as a euphemism; and appalling pictures have been drawn of the condition of the subsoil of our large towns, into which the gas-mains must be continually pouring vast quantities of explosive gas. The supposition is that, as nobody notices how or where all this gas gets away, it must be held in reserve under the impermeable surface of roadways paved in the modern fashion; and, granting the correctness of this plausible hypothesis, what a dreadful catastrophe must be in preparation under the very feet of the unconscious public! There is all the material here for the up-to-date *dénouement* of a shilling "shocker."

Happily for the public, as well as for the gas industry, all gas thus entered in the accounts of gas undertakings is not leakage, though some of it undoubtedly is, and even so much of this proportion as escapes from distributing mains and services into the subsoil of roads and streets cannot, by its very nature, stay there. In truth, the unaccounted-for gas of any undertaking comprises a large number of very elusive units. Besides the leakage, it covers all differences, from whatever cause arising, between the ascertained volume of the output and the registration of the consumers' meters, together with the estimated bulk of gas sold by contract. As it appears in gas-works accounts, it is an entry possessing both a commercial and a technical significance. Since it is a proportion of the total output that varies considerably in different places, it is a fair inference that the amount is principally governed by local conditions—that is to say, the state of the mains and services, and the care with which the distribution is looked after generally. This inference seems to meet very fairly Mr. Livesey's objection to Mr. Wright's conclusion that the bulk of the unaccounted-for gas is leakage. Mr. Livesey sees nothing in Mr. Wright's communication to prove this; but the inference is sufficient *primâ facie* proof, at any rate when the unaccounted-for gas amounts to about 5 per cent. of the output and upwards. When we come to instances of unaccounted-for gas amounting only to 2½ per cent. or thereabouts, the inference is changed, and the bulk of the discrepancy is to be regarded as explainable by reference to the other influences mentioned by Mr. Wright and Mr. Livesey.

It is an important point of these considerations that whatever apparent losses of gas may be due to cooling and the condensation of water in course of distribution, as well as the "turn" of the meter registration in favour of the consumer, show most in the winter quarters; while the actual leakage would be proportionately heavier in the summer. The street-lamps, also, invariably burn more gas than is charged to this account; to say nothing of the very high proportion of waste which goes with street lighting. The whole subject is as important to the gas manager as it is difficult and occasionally troublesome. All other things being equal, he is the happiest manager whose unaccounted-for ratio is the lowest. There are several gentlemen responsible for the higher and lower figures in Mr. Wright's comparative tables from whom we should like to hear on the matter.

Flooded Gas-Works.

THE sympathy of those gas managers whose works happen to be situated well above flood-mark will be extended to their less fortunate brethren who have been afflicted during the past week by the inundations that have put so much of the country under water, more especially in the Southern and Western Districts. The most

considerable place that has suffered in this way is the city of Bath, which was put in darkness on Thursday through the flooding of the retort-houses. Next in order of importance comes the Royal Borough of Windsor, to which the Court returned just in time to experience the inconvenience of a deluge. Lewes, Abercarn, St. Ives, Okehampton, and several other towns, have experienced more or less of the same kind of trouble. As we write, news comes that the floods are everywhere abating; but it will be many days before the Thames Valley, and some other low-lying areas, can resume their normal aspect. It is unnecessary to dilate upon the seriousness of the condition of affairs which we are obliged to pass over in a few lines of general comment. From such dreadful visitations as fire and flood, human industries are powerless to protect themselves. We may be sure that the responsible officers of the gas-works which have been drowned out, or otherwise damaged, during the past eventful week, will do all that is possible to repair the mischief that they may have to some extent foreseen, but were unable to avert; and there is no reason to think that the public will be lacking in the patience which gas makers and consumers alike must exercise under these circumstances. Let us not be so ungrateful as to omit mention of the help that the much-abused petroleum has rendered in places where gas making has perforce been temporarily suspended. But for the humble oil-lamp, the inconvenience felt by the dwellers in the flooded districts would have been greatly aggravated. When the trouble is over, we trust that any gas manager who may have had exceptional experiences in connection with the floods will commit them to writing for the benefit of our readers or of the District Association to which he belongs. Such communications will be received with sympathetic welcome.

The first reflection that occurs to the professional mind upon reading the newspaper reports of such disasters as those of Bath, Windsor, and the other works already mentioned, is that the time-honoured practice of placing gas manufacturing stations in the lowest parts of the districts to be served by them, has a very serious drawback. So far as Bath and Windsor are concerned, it is doubtful if the first designers of the gas-works had much choice of site; and now, of course, there is no other course left open to the engineers of these and other establishments of the kind similarly situated, but to make the best of it. The lesson of the inundations should not be lost, however, whenever or wherever the situation of new works has to be considered. There is only one reason why a gas-works should be put down at the lowest level of the district; and this reason is not of paramount importance. Considerations of water carriage for coal frequently combine with that relating to the distribution of gas to induce engineers to favour a low-lying site; and when inundations only occur at long intervals, it seems to savour of timidity to take steps—perhaps at great expense—to keep out of their way. Such a flood as the present, however, if it comes but once in a lifetime comes too frequently. The more popular gas becomes in all its manifold applications, the more essential it is that the service should not be interrupted for a single instant. Another "moral" to be drawn from this Wessex deluge is that directors of low-lying works should not expect their manager to live upon the works. This is perhaps a larger question than can be properly discussed in this particular connection; but it is certainly not foreign to it. For the rest, we can only wish our flooded friends a week or two of fine and bright weather to dry their drenched factories; and hope that the sudden invasion of water into the retort-houses has not shattered the benches, which have still the heaviest work of the year before them. The partisans of water-gas plant may be expected to put forth endeavours to turn the occasion to account in their own interest; and it would not be surprising if just at present, in the estimation of Mr. Ellery, of Bath, or Mr. Wadeson, of Windsor, the type of all that is lovely in gas-making plant is something made of iron, and situated on the top of a hill.

Projected Fresh Gas Legislation for Dublin.

The first of the projected Bills for the next session of Parliament relating to gas supply which has come under our notice up to the present time is that of the Corporation of Dublin. This is to be an Improvement Bill of the usual "omnibus" pattern, proposing to alter the constitution of municipal Dublin in a vast number of particulars. It is to be gathered from the local newspapers that public opinion, even when in a general way on the side of the Corporation, is more than half disposed to be afraid of this sweeping scheme of legislation, under which a careless or an extravagant Town Council would be able to put an enormous additional burden upon the rates. The proposals of the Bill in regard to the Alliance and Dublin Consumers' Gas Company will, at any rate, give occasion for one more of those bitter and costly struggles between the Company and the Corporation which have marked the history of the gas supply of Dublin during the past few years. The Corporation will aim by their Bill at obtaining unlimited control of the gas-testing arrangements; and this, of course, the Company are bound to oppose. The gas is at present tested by an independent Gas Examiner appointed by the Board of Trade—Professor Tichborne—who made a year's grand average, to the beginning of this month, 16·54 candles. The Corporation have an officer who tests the same gas in his own way; and he makes the year's average no more than 13·9 candles. The Corporation habitually hint at the existence of all sorts of malpractices on the part of the Gas Company; while they and all their officials are, of course, infallible and immaculate. They dare not say anything against Dr. Tichborne; but they do assert that he tests by means of "an instrument 26 years old"—we quote from the Lord Mayor's speech at the meeting held on the 12th inst. It was not said that the instrument was improper or defective, so we may safely assume that it is strictly what the law requires it to be. The Corporation further want to use a portable photometer; and also to alter the Company's initial price—not that high dividends have actually been paid, under the sliding-scale, upon the basis in force for Dublin, but because such dividends might be paid if the Company had the money. Of course, the Lord Mayor disclaims all desire to be unfair to the Company, while making the most one-sided comparisons between the gas affairs of Dublin and those of Belfast, London, Plymouth, and a number of picked localities. His Lordship thinks "the facts require to be investigated;" and this they certainly will be, in Parliament, and at the expense of the ratepayers of Dublin. But the facts in question will be very different from the farrago of allegations and imputations dressed up by the Corporation to give colour to this fresh attack upon the Company. Meanwhile, it is quite possible that the Dublin people will take fright at the proposal to promote in their name a Bill which is all for spending money and increasing rates, and take action for restraining this exuberance of their representatives.

A German View of the Gas Industry in the United States.

The report of Dr. Bunte upon the gas industry in the United States, an abstract translation of which appears in another column, is a composition worthy of its very distinguished author. Nothing can be more graphic than Dr. Bunte's opening sketch of the comparative positions of gas and electric lighting in New York and Chicago. On the first glance, gas would seem to have been banished from these cities—only the unused street-lamp columns, with their cross-bars, standing in the principal thoroughfares like "memorial crosses to a dead "industry." Closer inspection, however, revealed to the clear-sighted German engineer that here, as elsewhere, the bulk of the private and business lighting is still done by gas. The larger the town, as a rule, the heavier is the gas consumption per head of the population; but there are some glaring inequalities in the tabulated information collected by Dr. Bunte on this point which call for some explanation. It would be interesting to be informed, for instance, why the gas consumption per head of the population in New York is nearly double that of any other community in the States. Dr. Bunte discusses the reason for the expansion of the water-gas industry in America, which he finds to lie not in any scarcity of suitable gas coal, but in the prevalence and cheapness of oil. It appears, from what he has to say upon this head, that the Americans hardly know what to do with the products of oil distillation which are not extensively exported. These are burnt for fuel and used to carburet water gas; and, meanwhile, the gas coal remains in the ground. Of the two principal types of carburetted water-gas plant—the Lowe and the Wilkinson—Dr. Bunte appears to prefer the former; but he does not overlook the fact that, notwithstanding all the now well-known advantages possessed by water-gas as

compared with coal-gas manufacture, the former is not actually cheaper than the latter, light for light. Dr. Bunte concludes his report with several instructive observations of a critical cast; and he can claim to have fairly performed the task he undertook, of making his German colleagues acquainted with the technology of gas manufacture in the United States.

Mr. A. J. Balfour on the "Union Stroke."

In a speech recently delivered at Sunderland, Mr. A. J. Balfour offered a working-class audience some of the soundest economic doctrine which it has ever been our good fortune to discover in an address of a modern political orator. So much trash is vented by the self-styled "leaders" of working men in this country, that it is a real treat to hear of a politician, whose aim must ever be to be popular, daring to stand up in public and tell the Social Democrats that they are "small in numbers, insignificant in political power, "and utterly wrong in all their principles." And he went on to demolish these principles, regardless of the fact that they constitute the basis of modern Trade Unionism, which is nothing if not political. Speaking of the produce of the trade and industry of the country, Mr. Balfour showed that those who represent society as if it consists of two sections, each disputing for a share of the general produce, utterly mistake the real bearings of the great social problem. The true interest of the working man, as of all other members of the community, consists in increasing production. The more production is increased, whether by the improvement of machinery or the improvement of the workman, the better for everybody. As to the eight-hour day movement, Mr. Balfour applauded it if it meant an agency for increasing the productiveness of the workman and of his tools. He said: "There have "been most interesting experiments tried on that point "in various places, and I have no doubt in my mind— "without endeavouring to lay down too broad a proposi- "tion—that there are industries and there are populations "who produce not less but more when the hours of labour "are reduced within certain limits." And his natural conclusion in this regard is that "it is the business "of employers and the employed, and it is the business "of that public opinion by which both employers and "employed are largely controlled, to discover in each "industry and in each locality what are the hours in which "it is possible for a man to produce to the best advan- "tage; for the conditions under which we produce to the "best advantage are those under which we work with the "greatest pleasure to ourselves and with the greatest "profit to the community." Then, as to the New Trade Unionists who look to the eight-hour movement for salvation because they hope it will make labour less productive, Mr. Balfour declares in the plainest language that the idea is a fallacy. He tells the Socialists that their fundamental error is in devoting themselves to considering the distribution of wealth, to the neglect of its production; "and if "through foolish legislation, if through the adoption of "any of the crazy schemes which are laid before the "people of this country for their acceptance, we really "strike at the springs of our industry, it is perfectly vain "for us to consider how we have organized our means of "distribution, for we shall have destroyed at its source "our means of production." In other words, as we argued in these columns on the 2nd ult., it is the most efficient producer who controls the market; and the policy which is symbolized in the "Union stroke" points the way to ruin for those who accept it.

WATER AND SANITARY AFFAIRS.

The long experience and the established reputation of Sir Robert Rawlinson as a sanitary engineer give especial weight to the conclusions expressed by such an authority on the subject of the Metropolitan Water Supply. Additional force attaches to such conclusions, when given *ex cathedrâ*, as they were on Tuesday last, forming part of the Inaugural Address delivered by Sir Robert as President of the Institution of Civil Engineers, at the opening meeting of the present session of that body. In the course of the address, the present and future water supply of the "ever-increasing millions" who live and work in London was declared to be a question of vital importance. In reviewing the situation, Sir Robert pronounced the sources of both the Thames and the Lea to be as pure and as free from objection as any that could be found. The waters so obtained were hard, but had the merit of not acting on lead. As for enlarging the present supply, so as to meet the wants of an increasing population, it was signified that additional supplies of water for London might be obtained "in or near the areas through which the "Thames and the New River flowed." By this, of course, is to be understood the valleys of the Thames and the Lea. In fact, the views of Sir R. Rawlinson are those of the recent Royal Commission. But Sir Robert goes a little farther than the Commissioners; for he discusses the subject of proprietorship. He leans to the idea that the undertakings of the existing Water Companies should be consolidated and purchased. He would probably consider that purchase should be so carried out as to comprehend all the undertakings, thereby of necessity effecting their "unification." Certainly there is nothing in the presidential address to countenance the notion of buying up one or more of the London Water Companies, in order to damage the rest. To establish rival Companies and a competing supply, for which purpose additional mains would have to be laid in the already choked subsoil of the London streets, is a suggestion scouted as "impossible." So also to bring in soft water from a distance is objected to as "costly;" and at the same time the hard water is approved. The works being bought up, and the undertakings "consolidated," in whose hands are all to be placed? Sir Robert does not shut out the County Council; but he speaks as if he would rather prefer a special Water Trust. We can readily believe that his knowledge of what is involved in the conduct of the Metropolitan Water Supply renders Sir Robert doubtful as to the wisdom of placing so huge a concern at the mercy of a variable and possibly factious Committee at Spring Gardens. The works duly purchased, "any necessary extensions" could follow. But there is no shadowing forth of a new supply, to be brought from the mountains of Wales or elsewhere, at an enormous expense. The strata over which the rivers flow in the vicinity of London are described as geologically favourable to the supply of "sweet" water; and the volume flowing in the rivers is spoken of as water that is "living." To the use of open rivers no objection is made, providing proper care is taken to exclude pollution. We do not trace the biological argument in the presidential address; but the famous case at Hamburg and Altona serves to show that a polluted source can be so purified as to yield a safe supply, while a comparatively pure source without such a safeguard proves fatal to the public health. Sir Robert speaks of the house-boats on the Thames; but perhaps he is hardly aware of the vigilance exercised by the Conservators in looking after these "abominations." He would like to see them entirely excluded; but we can hardly suppose this possible, though something might be done to limit their number. So far as the broad question of the London Water Supply is concerned, the Metropolitan ratepayers may be congratulated on the fact that the Institution of Civil Engineers, as represented by its President, gives no support to the tortuous and dangerous policy adopted by the County Council. The latter body differs from the former, inasmuch as the Council has a particular purpose to serve apart from that of furnishing London with water.

Whether or not it is at all probable that the London Water Supply will ever become the property of the County Council, that self-confident authority is indulging in a large expenditure of money on the subject. The Council having very nearly spent the whole of the £10,000 authorized by the London Water Act of 1892, in carrying on "inquiries" respecting the water supply, as well as the money raised for the same purpose under the General Purposes Act of 1890, a proposal comes before the meeting to-day, as "a matter of urgency," that parliamentary powers be sought for another outlay of £10,000 in pursuit of knowledge on this recondite subject. This will be independent of the heavy costs which must needs be incurred in bringing forward eight separate Bills for the purchase of the undertakings of the several Water Companies. The Bill for introducing a new supply—the "survey" being, we presume, not yet complete—stands over for a year The Chelsea Water Company are doing good service, by promoting a Bill for additional works, to be constructed at Molesey and Surbiton.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 989.)

THE chief departments in the Stock Exchange continued very quiet last week; and there was little by way of incident to cause much variation in prices. In the Foreign market, however, and in our home rails, there was a shade of improvement, notwithstanding paucity of business; but the American market still languished and receded to a slight extent. The most noticeable incidents were to be found at the two extremes—viz., the choice gilt-edged luxuries on the one hand, and the speculative mining adventures on the other. The latter were very brisk and enterprising; while the former pushed up, till Consols beat the record with a mark of 103, which was more than once repeated. The Money Market showed more animation; and better rates were obtainable. In common with other good things, Gas stocks were strong and buoyant. Business, however, was decidedly more restricted in point of volume; and some days were very quiet indeed. As might be expected, changes in price were few in number; but all tended in the upward direction. In Gaslights, "A" was quieter than it has been of late, and it still maintained the old unvaried level; business being done at 250½ every day of the week. The secured issues, too, were less dealt in; but the demand for choice investments kept them at high figures. South Metropolitans were daily dealt in to a moderate extent, and at improving prices; and all three issues of the ordinary stock were quoted at a rise. Nothing was recorded in Commercials, but one special bargain. The Suburban and Provincial Companies were again conspicuous for the prices commanded by such stock as came into the market; and Brentford and Brighton advanced their quotations. The Continentals and the rest of the Foreign undertakings were very quiet, in common with the majority. Variations are few and slight, and mostly attributable to *ex div.* adjustment of value. The Water Companies were almost stagnant. But prices were very firm; and one or two quotations have advanced.

The daily operations were: The Gas Market was very quiet on the opening day, and quite devoid of any feature but firmness; and quotations did not move. The general position remained unchanged through Tuesday; and again quotations remained stationary, except for a reduction of ¼ in Oriental. Business on Wednesday was just as sluggish; and quotations closed again without variation. On Thursday, there was a little more animation, but not much. Quotations, however, broke free. Brentford new rose 3; and Brighton and all three South Metropolitans, 2 each. In Water, Lambeth and West Middlesex advanced a point each. Business lulled again on Friday; and no change took place. Saturday was about the busiest day of the week; and everything was firmer and unchanged.

ELECTRIC LIGHTING MEMORANDA.

The Cannon Street Accident—Light Railways and Electrical Traction—The Sensitiveness of Electrical Distribution Systems—Independent Electric Lighting in the United States.

THE disquieting accident in Cannon Street, to which reference was made in our editorial columns last week, attracted some attention in the London newspapers, and is not likely to be forgotten for some time by the public who use the City streets. As philosophers are fond of pointing out, a little thing that comes under our own personal notice affects us more than the hugest catastrophe occurring on the other side of the globe; and the malignity of Fate could have hit upon no more conspicuous place for an exhibition of the hidden dangers that underground electric light cables have brought among us, than the street corner opposite the Cannon Street Railway Station about the hour of leaving work on a Saturday afternoon. It is not likely that much more will be heard of the affair; for it is obviously to the interest of the City of London Electric Lighting Company that they should pay handsomely for the slaughtered horse, and compensate the injured wayfarers, and so prevent further public discussion of the incident. As it is, coming on the top of several annoying breakdowns of the lighting service, the accident in question will serve to point the criticisms that the general arrangements of the Company have recently received from independent electricians. Of course, no electric lighting system is deally perfect; but it is permissible to argue that the City of London is entitled at least to the best working system that can be had for money. At any rate, the Company who have undertaken to supply the City with electric light have not spared capital in the endeavour to discharge their obligations.

The partisans of electrical traction have pricked up their ears over the offer of the Board of Trade to convene a conference to consider the question whether anything can be done in this country to encourage the construction of light railways. On the face of it, there does not appear to be any reason for doubting that the construction of light railways, by which we understand railways of narrow gauge intended to be worked at low speeds, would be facilitated by relaxing in their favour the requirements which rightly enough apply to ordinary lines of railway. Electricians seem inclined to think that light railways of this description would offer a good field for the employment of the trolley system of electrical traction; and the opinion is one that need not be cavilled at on the grounds that are generally regarded as forbidding the use of this system for street tramways. It may be assumed that a light railway would differ from a tramway chiefly in having a right-of-way of its own possibly alongside, but not actually in, existing roads, except at level crossings. For such a line the trolley wire would be no more objectionable than the telegraph or telephone wires which are now such common objects of the country. We hope that if the movement for the provision of light railways in parts of the kingdom considered to need such accommodation results in anything tangible, the electricians will have a chance of showing what they can do on their merits with the trolley-wire or other systems of traction. In the United States, where the street railway companies own the municipalities, the ostensible success of any particular system of traction means little more than an illustration of the results of some "combine;" and up to the present time the trolley-wire system has had no opportunity for approving itself in a less highly-organized community.

The extreme sensitiveness of some systems of electric light distribution to sudden alterations of the load has been brought out by some observations recently appearing in the *Electrical Review*. Surprise having been expressed in that publication at a statement to the effect that the sudden putting on, or taking off, of 50 ampères could make a noticeable difference to a central station supply, a correspondent wrote to say that he could corroborate the statement. The writer remarked that, in the town of "X," in testing meters he had to be very careful. If during the winter, when 2000 to 3500 ampères were going out, he put on a meter circuit taking 60 or 80 ampères, down would go the pressure 5 or 6 volts—which is, of course, more than enough to set all the lamps in the town blinking. It is also asserted that at the Deptford station they never could make out why the London consumers complained about the unsteadiness of the light, until they found out that meter-testing was going on at Adelphi Terrace. "X could not stand a sudden change in load of 50 ampères without the town lights showing it, and being corrected for by hand regulation on the machines;" and the writer believes the same applied to Deptford. If this is generally the case, the frequent and irritating blinking of electric lamps, from which few central station supplies are free, is in a measure accounted for.

Writing in the *Engineering Magazine* on the subject of domestic electric lighting plants, which is a branch of electrical industry that appears to be in a remarkably backward condition in the United States, Mr. N. W. Perry admits that, even in American towns of considerable size, "the electric current, on account of its greater cost than gas, still remains a luxury." It will be somewhat surprising to those good people who believe, on the strength of newspaper generalizations, that all kinds of applications of electricity to the service of mankind are more advanced in the States than anywhere else in the world, to hear from an American source that England and Germany have "far outstripped us [Americans] in the solution of the problem of cheap domestic electric lighting." This statement means with Mr. Perry that the employment of gas-engines for generating electricity to be used in lighting has been more favoured in Europe than on the other side of the Atlantic. It is not that gas-engines are not much used in the States; for although this class of motors is more popular in England and in Germany than they are as yet in America, still the number of them in use in the States is "quite large," while only an insignificant percentage is in connection with electrical generating machinery. The generation of electricity by gas power seems to be a growing practice in America; and where gas can be had for about $1 per 1000 cubic feet, it is a cheap way of procuring electric light. Even with gas at $1·50 per 1000 cubic feet, and using an accumulator, which almost doubles the cost of the light, private consumers find they can do their own lighting at about the same cost as they can purchase current from a town station. Several things may be learned from this article; not the least important lesson being that of the continuance of electric lighting as a luxury for the rich, even in the land which claims to be the home of the industry. That English and German practice in the matter of independent domestic electric lighting should be regarded as a model for Americans to copy, is not news to well-informed electricians; but it may be commended to the attention of members of local authorities and others liable to deception in this respect.

Resignation of Mr. R. S. Gardiner.—It is with considerable surprise that we hear how shortly the Imperial Continental Gas Association is to lose the services of its able Secretary. It is matter of common knowlege that to his energy and indefatigable enterprise the undertaking owes much of its prosperity during the past fifteen years; and it is, no doubt, this repute which has now obtained for him a more lucrative appointment. Mr. Gardiner has accepted the post of General Manager to the Pelton Colliery. We have to heartily congratulate the owners on the bold bid which has secured them his services, and to wish him all success and prosperity in his new sphere of action. We should imagine it will not be easy for the Directors of the Association to find a Secretary who unites to all Mr. Gardiner's other recommendations his facility in foreign languages.

THE DANGER OF MODERN GASHOLDER PRACTICE.

The modern tendency to enlarge gasholders, and of course their tanks also, has already made great headway in all parts of the world; and as there is great probability that further progress will be urged in the same direction, by a variety of influences that need not be particularized here, it is desirable, in the interest of public safety, that the attention of gas engineers and gasholder builders should be sharply and strongly drawn to the necessity of their possessing themselves of the fundamental principles by the observance of which, in design and construction, the new fashion of extending the capacity of gasholders and tanks can alone be prudently followed. It is indeed remarkable how the drift of opinion in gas engineering circles has changed of late with regard to this important question of the desirability of large gasholders. Not so very long ago, there was among what may be termed, without disrespect, the rank and file of gas managers, and their employers, a rooted distaste for "putting all their eggs into one basket." Few gasholders exceeding 150 feet in diameter were in existence even fifteen years ago; and when Mr. George Livesey entered upon his daring series of experiments in gasholder design, which have actually succeeded in revolutionizing the sentiments of the profession in this department, prophets of disaster were not wanting to chide his rashness in the spirit which is so aptly expressed in the old saw just quoted. Fortified by close personal study of the conditions of security in gasholder building and working, supported by the best advice, and impelled by the peculiar needs of his own great and rapidly growing gas-works, the South Metropolitan Gas Company's Engineer and Chairman went on his way, disregarding warnings which were demonstrably mere croakings, until he has lived to witness, and has been constrained to moderate, the exuberance of some gasholder designers who would otherwise have rushed into risks which he himself was not at all prepared to take. It is the old story of the reformer and innovator who sees his views taken up only too ardently by perfervid disciples, and whose counsels of moderation in carrying them out are chafed against by neophytes led into extremes by an intemperate zeal unchastened by knowledge. In the present matter, to come at once to the point, we desire to enter an emphatic protest against the extension of the modern craze for hugeness in gasholder construction, which is shown by designers who think they are quite safe in attaining a vain desire for the possession of the biggest gasholder in their district, or the biggest tank of a particular description in the country, by simply stretching a few leading dimensions here and there, without sufficiently considering the effects of such alterations of scale upon the safety of the work as a whole, as well as of all its parts.

The copying of designs in gasholder and tank construction has always been a besetting weakness of gas managers who would be ranked also as engineers. Favourite types of gasholders have consequently been multiplied as they arose from time to time, until every indication of the studied adaptation of means to ends in such structures was overlaid by pure conventions, copied without a thought, and applied without principle. And, as is inseparable from this kind of "engineering," copies were made of copies, errors were repeated and aggravated, till such monstrosities as heavy girders secured (?) by means of a couple or so of small set-screws to the columns which they were supposed to stay, passed among the commonplaces of gasholder building. Across all this realm of stupidity, the modern fashion of rational design of which Mr. Livesey was the leader—we do not seek to imply by this that nobody else had a hand in the latter-day improvement of gasholder construction—flashed with dazzling effect. Gas engineers everywhere awoke to see gasholders as they were and as they could be made; and the positive economical advantages that were realized by those designers who made gasholders "with brains" soon swelled the number of those who were not only willing to put all their "eggs" into larger baskets, but eager to cut down the cost of the accommodation to the irreducible minimum.

This awakening was all very well so long as the material expression of the new ideas in gasholder construction was undertaken by competent hands. A true and competent man, if he has to make something of the same size as another man's work, and do it, moreover, by following the same principles, will nevertheless go over his own ground from end to end, making sure that he is right as he proceeds. He can never know by any other way that his forerunner and example does not contain some secret flaw, some oversight, which a generally successful result may for the time conceal. The sufficiency of every scantling must be established afresh, the propriety of the distribution of all materials with a view to the strength and endurance of the work must be reassured; with the effect that what eventually has almost the appearance of a replica is, to all intents and purposes, an original work. He is a wise designer who knows a good design when he sees it; but the steps which he takes to assure himself of the rectitude of his judgment distinguish such a designer fundamentally from the mere copyist, who will as soon copy a bad thing as a good one, and generally, by reason of the weakness of humanity, prefers the former.

The danger at present is just this—that the error of the unintelligent copyist in gasholder construction (for one cannot properly call it design) appears to have come round again. Large gas undertakings in different parts of the country are taking to large gasholders, and are taking them on the faith of the builders, or of inexperienced engineers, with insufficient guarantee that the conditions of safety and of durability are fulfilled. We are no alarmists; and our record in regard to helping forward the reform of gasholder design is clear enough to preserve us from suspicion of indulging in reactionary sentiments. The bare truth of the matter is that the latter state of those who trust to copyists in gasholder construction is likely to be worse than the first; for, whereas, before the new fashion set in, gasholders were not the huge structures they have since become, and were consequently more manageable in every way, it would be a much more serious business if one of the new-fashioned monsters were to go wrong.

What is true of gasholders is even more to the point in regard to tanks, because while it is fairly safe to copy successful examples of gasholder construction, provided the copying is thoroughly done—especially if with the aid of the builders of the original—there must be more left to local initiative in tank construction. A great business is now done, for instance, in the providing of wrought-iron and steel tanks, not only for gasholders but also for storing oil, tar, ammoniacal liquor, and so forth. We are credibly assured that some recent examples of this class of work betray a degree of ignorance of the first principles of safe construction which appears to invite disaster. It is not for us to mention names; but it is a matter of public interest that those who undertake the responsibility of putting down a big metallic gasholder tank should realize what forces they have to deal with, and how these may be met, with due regard to the liability of iron and steel to rust. There is no mystery about this branch of engineering, which is, indeed, among the simplest of all subjects of strain computation. A plain man, unskilled in any but the simplest mathematics, might have until lately been excused for inability to work out the strains of gasholders. Thanks, however, to a well-known guide, there is now no difficulty in the study of the elements of the strength and stability of gasholders, for anyone who will take the necessary trouble. The strains upon circular tanks are tabulated in very accessible books of reference. There is first the load upon the bottom, which is equal to the weight of the contained water; and then there is the bursting strain upon the sides, which is a result of the depth below the surface of the water and the diameter of the tank. It is asserted—but the assertion is hardly credible—that tanks have been "designed" in ignorance of the fact that a thickness of plate which would do for a 10-feet tank is insufficient for a tank 100 feet in diameter. The truth is that the strain upon the plates of a water-tank of circular section increases directly with the diameter. Thus, whatever may be the bursting strain upon (say) the bottom inch in vertical depth of the side of a gasholder tank 100 feet in diameter, that at the same depth in the case of a tank 200 feet in diameter will be just double. The rule which connects the strain upon a circular tank, pipe, or boiler with the thickness of the metal, is that "the greatest safe pressure per square inch inside, multiplied by the diameter in inches, is equal to twice the thickness of the metal multiplied by the safe working tensile stress of the material per square inch of section." In the case of tanks with riveted joints, the strength of the material must, of course, be taken as that of the joint only. Tanks may be reinforced by strapping; but this is only permissible in the case of cast-iron tanks built up of plates bolted together. With wrought-iron or steel tanks, the strength had better be put into the plates, for the sake of withstanding rusting. Of course, there is just as much strain upon the sides of an annular gasholder tank as there would be if the middle were filled with water. When such tanks are sunk below the surface of the ground, some little extra strength may be lent to them by the resistance of the earth filling and the weight of the ground water, if any; but no reliance can be placed upon such adventitious aids, which may be withdrawn at any moment. Some useful tables for facilitating calculations in regard to gasholder tanks, &c., are given in the catalogue recently issued by Messrs. R. and J. Dempster, Limited, of Manchester.

We have no particular instance in view to "point the moral" of this warning, although something that might serve the purpose would not be far to seek. Our object in bringing the subject under the notice of gas managers and others interested in it is the very serious one of cautioning all and sundry against running from one extreme to the other in regard to gas storeage arrangements. There is an objection, and a very cogent one, to unnecessarily increasing the size of gasholders and tanks, although it is not of the same nature as that vague dread of the risk of a "blowing up" which weighed upon the minds and tied the hands of constructors of the old school. When a vast number of eggs, to revert to the old adage, are put into one basket, there is all the more reason why the basket should be a specially strong and reliable one. Such vessels are not to be ordered "over the counter" of enterprising manufacturers, or erected under the sole advice of ordinary works' managers. If this sort of thing is perpetrated in the name of "progress"—say, by local authorities too stingy to engage proper professional assistance—there will be a big catastrophe one of these days, which might not be regrettable, perhaps, if only the damage could be depended upon to come on the responsible parties. Since this is certain not to happen, we give this warning betimes, in order that steps may be taken to keep modern gasholder and tank practice on the safe track.

TECHNICAL RECORD.

INSTITUTION OF CIVIL ENGINEERS.

Sir R. Rawlinson on the London Water Question.

The Opening Meeting of the above Institution for the present session was held on Tuesday last, when Sir R. RAWLINSON, K.C.B., the President, delivered his Inaugural Address.

At the outset, Sir Robert referred to the works of those who might, he said, be regarded as the fathers of British engineering—notably Sir Hugh Myddelton, who brought water by the New River from Chadwell for the supply of a portion of London; James Brindley, the Engineer of the Bridgewater Canal and other navigations; Smeaton, Watt, Stephenson, and Rennie; and lastly Telford (the first President of the Institution), whose roads, bridges, water-works, docks, and harbours had won for him universal renown. Proceeding to deal with the history and progress of civil engineering, the President remarked that in few branches had there been greater advance than in that which concerned the health and personal well-being of mankind. He had been engaged during upwards of forty years upon inquiries into the sanitary condition of the cities, towns, and villages of England, and upon works of sewering and draining. It might reasonably be said that sanitary engineering was not a science—it dealt neither with medicine nor with surgery; but its results were based on main sewering, house draining, water supply, and scavenging, and upon the establishment of public baths, wash-houses, and disinfecting apparatus for promoting personal and domestic cleanliness. In newly-developed countries, sanitary engineering should aim at a general improvement of the uninhabited portions, such as forest clearing and land draining, the formation of roads, bridge building, river improvements, and a judicious selection of sites for towns, villages, and houses. It had become usual to credit sanitary works—such as sewerage, drainage, and improved supplies of water—with the observed reduction of deaths in the district; and he was not inclined to repudiate this. But he also saw other powerful influences at work on this great and most interesting problem—viz., education, increase of temperance among all classes, better wages to the artizan workers, shorter hours of labour, cheaper food, cheaper clothing, and a wider-spread sympathy of class with class. There was no problem of sanitary engineering of vaster range than that presented by the great Metropolis. At present the streets of London were crowded to a dangerous excess with sewers, drains, water-pipes, gas-pipes, telegraph and pneumatic tubes, electric lighting cables, and hydraulic pressure mains. No city in the world, of which there was any history, was ever sewered on so great a scale as London now was; and yet the main low-level sewers were too small to relieve the area bordering the river. It had at times occurred to him that deep tunnel sewers, in lines irrespective of those of the streets above, might be found necessary to relieve the streets. In Paris there were such large underground tunnels for sewers, gas-pipes, water-pipes, and telegraph tubes and wires. The sewage of London (now wasted at great cost to the ratepayers) might be taken to the Maplin Sands, if these were embanked for the purpose, and on its way be delivered in dressings of liquid sewage over the poor adjoining lands, which would add tenfold to their productiveness, and provide useful employment for casuals clamouring at the doors of charity and crying out for work every winter.

Passing on to another branch of sanitary engineering, Sir Robert remarked that a question of vital importance was that of the present and the future water supply to the ever-increasing millions who live and work in London. The supply of water to London was still derived mainly from open rivers—the Thames and the Lea; and the important questions arose: Must these sources be continued? Must the interests of the Water Companies be bought? Must there then be consolidation of management, and, if so, under the London County Council or by a special Water Trust, similar to the case of the docks at Liverpool and other large trusts? When consolidation had been accomplished, should the rivers be continued as the main sources of supply for domestic purposes, or should new sources be obtained? These were wide, and they would be exceedingly costly, questions. They, however, required to be answered. What were the advantages of open river supplies of water for domestic purposes, if any? Open river water might be termed "living water." The waters of the Thames and Lea might be called "living," as they were in unceasing motion from their sources, and the strata in both cases were geologically favourable to the supply of "sweet" water. The Conservators of the Thames had, however, allowed the abomination of house-boats to occupy the water and the banks of the river. The powers of the Conservators had hitherto been insufficient to compel some towns and villages to abstain from polluting the river which provided London with water. But must all these abuses continue? Or was there some sort of explanation for their prolonged existence? The sources of both the Thames and the Lea were as pure or as free from objection as it would be possible to find water. The waters were hard; and such waters did not act on lead. The water-works were owned and managed by Companies. Consolidation and purchase seemed practicable, and then any necessary extensions could be made. To bring in rival water companies, and to attempt to lay additional mains in the already choked streets of London, would be impossible. To bring in soft water from long distances would be costly; while additional supplies might be obtained in or near the areas through which the Thames and the New River flow.

In conclusion, the President remarked that almost fifty years ago one of his predecessors—Sir John Rennie—on a similar occasion to the present, reviewed exhaustively the history of engineering up to that time. An epitome of the works and inventions of Civil Engineers during the last half century would form a worthy sequel to that address. They had spread a network of railways over the British Empire and its Colonies; they had maintained an unrivalled position in shipbuilding and in the construction of machinery; and with the aid of electricity, by bringing continents into closer communication, they had diminished the circumference of the world.

A cordial vote of thanks having been passed to the President for his address, he proceeded to present to the various recipients the medals, premiums, and prizes awarded at the close of the last session.

AMERICAN GASLIGHT ASSOCIATION.

The Annual Meeting in Washington.

The Twenty-second Annual Meeting of this Association was opened on Oct. 17, by the President, Mr. W. H. Pearson, of Toronto; and there was an excellent attendance. The usual business included the election of 19 active and 11 associate members; and the report of the Council set forth that eleven papers presented to the Association during the year, and published to the members by means of the "Quarterly Journal," had been approved to be read at that meeting. The report dealt at some length with the details relating to the publication of the "Quarterly Journal," and also mentioned that the Secretary is endeavouring to form a library of gas literature.

The President then delivered his Inaugural Address, which has already been fully summarized (*ante*, p. 869); and after this, Mr. Walton Clark, of Philadelphia (the President-elect), read a paper entitled "Public Ownership of Gas Properties." He said that conscientious socialists looked upon the acquisition of gas, telegraph, and railway properties by the State as the thin end of the wedge that would split our present industrial system; whilst the socialistic demagogue approved of anything that would increase his power, or secure favour with his electors. Referring to Charters granted to Municipal Corporations, Mr. Clark claimed that they were formed for the protection and encouragement of private enterprise, rather than to enter into competition with it; and that before taking up anything that could be done by private enterprise, they should show special reasons for doing so. It was argued that gas was a necessity, and that all necessary monopolies should belong to the public; that it involved disturbances of the streets which were under the control of the municipality; and that the large quantity of gas used for public lighting gave the city a special interest in gas supply. Also that the function discharged by a gas company could be performed better and more cheaply by the municipality; and generally that public ownership tended to purity and efficiency in the management of public affairs. Mr. Walton Clark proceeded to show that gas was not used in every house, like water; and therefore it was not strictly a necessity which every householder must have. It was necessary that the water supply should be guarded from depletion or contamination; but no corresponding regulation was necessary in regard to gas. With reference to the use of the streets, the public were not affected by the ownership in any way. Whether the ground was opened by a private person, a company, or the public officers, the rules as to filling up and repair were the same; and pavements or roadways broken up by a company were as promptly repaired as if a sewer or other public work was being carried out. So a change to municipal ownership would make no difference to the public in this respect. He contended that the public lighting was not such a large part of the whole gas supply as to give the municipality a preferential interest in the manufacture of gas; and, further, it could not manufacture every article it required. As to purity of management, that was a question of personal character which was outside any question of ownership. Then there was the cheaper and better management; and it was shown that a regulated monopoly granted to a company was the best way of securing this. It was only in the item of "interest" that the municipal authorities could expect to save anything; and the idea of their making money by the sale of gas was utterly repugnant to all sense of equity. There was no reason why the credit of a properly established private company should not be as good as that of a municipality. The conclusion arrived at was that a municipality cannot supply gas on better terms than a private company. A great deal had been said about the cheap gas at Wheeling and at Philadelphia. But, according to published statistics, it would appear that, after allowing for depreciation, &c., gas was sold at these places for less than cost.

Mr. Boardman opened the discussion, and spoke in support of the author of the paper. He considered municipal control of gas-works as a danger and harm. If they sold gas too cheaply, an injustice was done to the ratepayers; and if they made a

profit, then the district profited at the expense of the gas consumers. Gas was not the only source of illumination; and therefore it could not be called a necessity. But the effect of municipal control was to reduce the natural competition with other agents. In towns where the public authorities owned the gas-works, he would like to know where the profits went to? Or if there was a loss, how it was met? Mr. Williams also agreed with the author to the extent that if the local authorities secured from the gas company, in return for the monopoly of sale, proper regulations as to quality, price, testing of meters, inspecting of fittings, &c, more benefit would be done both to producer and consumer, than by going into the business on their own account. Mr. Littlehales contended that the management of a gas-works by a changeable organization would more than counterbalance any possible advantage that could be obtained in the way of raising capital at low rates of interest; and he urged that local authorities had no right to sell gas at a profit. Mr. C. J. R. Humphreys said the reason a municipality could borrow at a lower rate of interest than a company was because it was not supposed to be a trader. Directly it went into trade, it lost that advantage, and would not command better terms than the company. Mr. Keppelman, speaking after fifteen years' experience in public business, urged that it was not a question of 4 per cent. bonds, but of management, and that no city ought to indulge in commercial ventures. He was in favour of having a gas commission. Mr. Fodell said several other things could be shown to need control as well as gas, and to affect the public interests. Why not, he asked, have a large bakery, and supply cheap bread? Mr. Clark, in reply, gave an instance to show that many who advocated municipal control really did not understand the subject.

(To be continued.)

Mr. W. C. Dixon has been elected Chairman of the Gas and Electricity Committee of the Bradford Corporation, in succession to Mr. Alderman Moulson.

Mr. R. Garraway Rice has been appointed to the vacant seat on the Board of the Singapore Gas Company, caused by the death of Mr. F. A. M. Nicol.

Issue of Additional Debenture Stock by the South Metropolitan Gas Company.—The South Metropolitan Gas Company announce a sale by tender of £25,000 of 5 per cent. perpetual debenture stock, at a minimum price of £157 per cent.

Death of Mr. W. White.—We regret to record the death early last Saturday morning, at Margate, from heart disease, of Mr. William White, who was formerly Engineer and Manager of the Woolwich Equitable Gas Company, now amalgamated with the South Metropolitan Gas Company.

Mr. Walter Pettigrew, of the Meadow Lane Gas-Works of the Leeds Corporation, has been promoted to the position of Chemist and Tester to the Committee, in place of Mr. Everitt, who, as already intimated in the JOURNAL, has received the appointment of Manager of the Ilkley Gas-Works.

Additional Capital for the East London Water Company.—The Directors of the East London Water Company are inviting tenders for an issue of £100,000 of 3 per cent. debenture stock; being the first portion of the £500,000 authorized to be raised under the provisions of the Act obtained last session. The stock is redeemable after the expiration of 25 years from the date of issue, subject to six months' notice by the Company.

The New Mayors.—In addition to the new Mayors identified with gas or water supply mentioned in the JOURNAL last week, Alderman W. Smith, who has filled the position of Chief Magistrate of Chichester six times—the present being the third in succession—was one of the founders of the Chichester Water Company, of which he has been Chairman since the establishment of the undertaking upwards of twenty years ago. Alderman Gilston, the new Mayor of Leeds, was Chairman of the Gas Committee of the Corporation until the close of the last financial year.

Presentations to Mr. W. Arnott, of Cape Town.—The termination, at the close of the past month, of the engagement of Mr. W. Arnott as Manager of the Cape Town Gas Company, was regarded by the local Directors as being a suitable occasion for expressing their appreciation of his services in that capacity, and their regret at his departure. A few kindly remarks having been made by the Chairman (Mr. J. W. Attwell) and one of the Directors, Mr. Arnott was presented by them with an illuminated address and testimonial, which were acknowledged in suitable terms by the recipient. Mr. Arnott also received an illuminated address from the staff, and a travelling-bag from the men.

Manchester District Institution of Gas Engineers.—We learn from the Secretary of this Institution (Mr. S. S. Mellor, of Northwich) that the 100th quarterly meeting will be held next Saturday, at the Palatine Hotel, Manchester, under the presidency of Mr. J. Braddock, of Radcliffe. The business will consist of the election of five new members, as well as the President for the ensuing year, and of the reading of three papers—one by Mr. W. R. Chester, of Nottingham, on "Some Experiments in Greenhouse Heating by Coal Gas;" another by Mr. A. T. Fletcher, Assoc.M.Inst.C.E., of Leigh, on "Inclined Retorts at the Leigh Gas-Works;" and the third by Mr. Robert Porter, of Elland, on "The Advantages of Mechanical Appliances in Medium-Sized Gas-Works."

SOUTHERN DISTRICT ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

We complete to-day our report, commenced last week, of the proceedings at the autumn meeting of the above Association, by giving the remainder of the technical business.

Mr. F. G. DEXTER (Winchester) read the following paper:—

OUTDOOR LIGHTING BY THE INCANDESCENT BURNER.

Our indefatigable Secretary extracted a promise from me some time since to give some tangible proof of my interest as a member of the Association. To do this in a manner at all worthy of past records with any one of the well-worn subjects, I have not felt prepared; but the opportunity now occurs to say a few words descriptive of my experience in the new field forming the subject of this paper, and perhaps help to stay the deluge of correspondence and inquiries with which the venture has provided me.

It is now some twelve months since the idea of utilizing the extremely powerful rays of the Welsbach gas-burner for street lighting occurred to me. Necessarily, a few points—such as the extremely fragile character of the mantle, the nuisance of glass chimneys, and the possibility of the whole thing becoming wrecked during very boisterous weather (when perhaps good lighting is more than ever necessary)—at once presented themselves; but since failure is only the forerunner of success, the shortest way was undoubtedly to find the value of the weak points first. In order to do this two of the ordinary "C" burners without bye-passes, were placed in very exposed situations on our own premises—the one in an ordinary street lantern unaltered in any way; and the other in one of Sugg's "Refuge" lanterns. Within a few nights, we experienced a gale that stripped two-thirds of the roofs of our buildings; but the burners stood the test admirably, considering the conditions. The Sugg "Refuge" proved the better retreat, simply because of the better workmanship in the fit of the door and panes, and superior arrangement of exit at top; the light in this lantern remaining fairly steady. The ordinary street lantern was too draughty everywhere, and caused a strong wave-like motion in the intensity of the light; but at the same time it was not extinguished.

Experience gained during association with my former chiefs, Mr. Botley and Mr. Riley, in connection with the lighting of railway carriages satisfied me that, if a small flat flame could be made to burn steadily in much smaller lanterns, and under the extreme conditions of rest at a station and very high speed in the teeth of a gale, the alterations necessary to the street lantern should prove of simple character and easily devised. The ignition of the burner was not to be thought of with the aid of the ordinary clumsy torch, through risk of damage by hurried contact with the chimney, and the impossibility of keeping the bottom of the lantern in a tight condition. Opening the door to light by hand would necessitate carrying a ladder; and, in addition, the mantle would be very liable to be lifted from the fork support by the wind. The preparation of the street lantern resolved itself into the provision of well puttied-in panes (a precaution since found hardly necessary, except under extreme conditions, a well-fitted puttyless lamp answering equally well); the closing of the bottom of the lantern with four fixed whole squares of glass, with the exception that one square at the corner nearest the centre of the lantern had a small triangular piece of glass removed, and a similar piece of strong gauze substituted; and the exit at the top of the lantern was simply surrounded with a piece of rather coarse gauze, kept about ½ inch away from the lantern top proper, so as to baffle external wind, and yet allow free exit to the burnt gases.

The only way to deal successfully with the question of ignition seemed to me to adapt the bye-pass "C" burner to the lantern above described, not only to avoid the difficulties already mentioned, but to secure other advantages—viz., less risk of injury to the mantle from repeated shocks in lighting, and the use of the warmth from the bye-pass jet to counteract deterioration of the mantle from damp. In order to work the bye-pass from the ground, and with the same torch as the men used for lamps of the ordinary kind (and without having to open the lantern), I had the small lever of the bye-pass tap slightly lengthened and flattened at the end. To the flattened end was attached by a small pin a light rod, which was passed down through the triangular piece of gauze in the bottom of the lantern before mentioned, and terminated by screwing into the centre of a small metal disc (about the size of a halfpenny) 2 inches or so below the bottom of the lantern. To the opposite side of the plug of the bye-pass tap, a small weighted lever was added to counterbalance the weight of the rod, &c. On the end of the torch at right angles, a small claw was fixed to readily engage the disc. To light up, therefore, the man simply pushed the head of the torch against the disc, and to extinguish pulled it down with the claw. This combination of lantern and burner was severely tested in the draught of a fan before erection (both fully alight and on the bye-pass), and then put into the streets last March. By arrangement with the Corporation of our city, thirteen lamps were erected at different points, to embrace all degrees of elevation; and at the same time the most exposed and trying situations were chosen—the police having stringent orders to report all defects. In addition to

these, seven more lamps were actually put into use under other arrangements, making 20 in all; and I am happy to say not a single case of failure has occurred.

My experience shows that, so far from proving troublesome in heavy weather, the burners are less influenced than the ordinary flat luminous flame. In the first place, there is much less surface exposure; and besides the shortcoming and stiffening of the flame by the admission of air, the fact that it is playing in and about the interstices of the mantle, helps to steady it, in addition to the protection of the chimney. With the bye-pass jet also, protection is afforded from its position within the double protection of mantle and chimney.

With regard to the chimneys used, the only practicable kind for street lighting purposes is mica. These, with care, will require only one renewal per annum. Glass rod chimneys were tried lately, but had to be removed the second night. Mantles may be taken to require renewal at the average rate of about six per annum per lamp, lighting all night the year round; but their life greatly depends upon the consumption of gas and the draught of the chimney. The burners should be carefully tested; and, if necessary, the holes of the jet burnished over to keep the consumption *within* 4 feet—3 to 3¾ feet in preference, under the maximum pressure they will have to stand. Many burners will run away to 4½ and 5 feet under 2½ or 3 inch pressure; and if this is not stopped, apart from the positive loss of light that results, the rush of gas speedily wears down the mantle—the destruction being assisted by the excessive draught of air through the chimney. I may here offer a word of caution in the use of the governors supplied with the lamps. Many are not suitable; and continually stick up or down. It is better to use the plain burner, and adjust the holes to the consumption needed.

The cleaning of the lamps is not necessary as often as with the ordinary kind. Of course, with a tighter lantern this might be expected; but assuming the conditions the same, the fact that the consumption of gas is reduced one-half, means that one-half only of the current of air and its accompanying dust is drawn in. When cleaning the inside, a weighted rubber disc, made to rest inside and on the top edge of the chimney, is given to the man. The use of this stops all tendency for wind to blow up through the chimney, and disturb the mantle. The burner is not moved. The Bunsen air-holes have become choked once or twice through the summer, by the accumulation of a mass of tiny flies and insects paying their homage to the power of the light.

Two other forms of lamp have been tried—a group of three "C" bye-pass lamps within a Sugg "Refuge" lantern, and the "D" pattern burner within a large square lantern. You are probably aware that the "D" burner is larger; the one we have fixed passing 6¾ feet, and what appears to me an important point as likely to effect a saving in the life of the mantles is that it has no chimney actually surrounding the mantle. A glass cup about 4 inches diameter fits into the gallery, and runs up with parallel sides rather above the top of the mantle. A metal reflector rests upon the top of this, having a central aperture and chimney above. With this form, the draught is far less severe; and if a mantle bursts, there is no material near enough for the flame to play on and injure. The mantles in this lamp have had by far the longest life. I understand that the Incandescent Gas-Light Company are now making this same form in the smaller "C" size; and, in my opinion, it is likely to prove the best arrangement for street purposes.

A special form of lighting tube is arranged over the chimney in some of the Incandescent Company's own lanterns, by which the gas, when turned on, is intended to be conducted by the tube to the outside of the lantern, and made to flash back, on the torch being held at the outside opening. I am unable to offer any experience as to the utility of this arrangement. It may answer under some conditions; but having found the mantles to last the longest where vibration and shock of every kind could be reduced to a minimum, I cannot say that the arrangement has commended itself to me as likely to equal the use of the bye-pass.

Discussion.

Mr. J. L. CHAPMAN said he had had some experience with incandescent gas-burners for street lighting, and was extremely pleased with them; so much so that, at the present time he was striving to have them put up throughout the whole of the main streets of Harrow. He started with one burner; and instead of putting it in one of the streets, he fixed it in one of the most exposed positions on Harrow Hill. The pressure of gas there varied extremely; it being some 200 feet above the works. They found considerable difficulty in the matter of pressure; but he took the top of the burner out of the old ordinary governor, and left the governor in, and so used two governors to control the pressure. The incandescent burner then gave a clear and splendid light. They had used it for three months, and had never renewed the mantle; the light remaining as steady and good as at first—not perhaps quite so good as the papers said of the incandescent light; but the illuminating power certainly approached 30 or 40 candles. This was with the "C" burner, which had been lately brought out by the Incandescent Gas-Light Company. Having mentioned that he had not tried chimneys, Mr. Chapman stated that six extra burners had since been put up—making seven in all; and they had 20 more in hand waiting for an opportunity to be fixed. From the beginning of the experiments, they had found no difficulty; and the lights were burning as well now as at first. Not a single mantle had been renewed; and he would say, with Mr. Dexter, that really the care and cleaning of the lamps were much less than under the old arrangement. He was very pleased with the light; and if it only acted as well in the future as it had in the past, he should like to illuminate the whole of the place with it. He had only recently returned from Italy; and, although he had not seen these lights in the streets there, he noticed that the great cafés almost everywhere—in Paris, Genoa, and Florence—were lighted by them. This seemed to him to prove that the light must be a useful one, because, as the members were aware, people abroad sat outside the cafés; and this showed that the light must have considerable endurance. He was strongly inclined to favour the bye-pass. In no instance in his experiment, had the bye-pass failed; and they still continued the system of leaving the lamps always alight—pulling down one chain to light the lamp, and the other to extinguish it. This had been done with the first lamp the whole of the time it had been in use; and with the other six, for about two months. The papers said the light was better than the electric light; and it certainly was better than the 8-candle power incandescent electric lamps that they saw in many places. As evidence of their durability, he said that after the seven lamps he had mentioned were put up, the roads were renewed throughout the town; and a 10-ton steam-roller was used continuously on the roads, and close to the edge of the pavements. The lamps did not break or show any signs of subsidence, although the roller was working in close proximity to them for something like a week. This light was one of the things that they, as gas engineers, ought to look into. It had raised strong opposition to an electric-lighting project which had been started by the Local Authority at Harrow; and the ratepayers had held a public meeting, at which they asked the Local Authority not to proceed with the scheme without further consideration. He thought this was greatly due to the good light obtained by the system Mr. Dexter had brought before them.

Mr. T. MAY, jun. (Richmond), remarked that he had not so far had any experience with the incandescent light; but he would like to ask Mr. Dexter what he found was the effect of a bad supply of gas. Had he experienced any trouble with the lights through naphthalene? He knew a case in South London where a man had 70 lamps to light; and he had only been able to light 20 of them through this cause. If there had been incandescent burners in these lamps, he supposed he would have had to take 50 mantles with him when he proceeded to light them. He could not see that they could possibly answer in a district where people were subjected to deposits of naphthalene in the service-pipes. He should like to ask Mr. Dexter whether he had had trouble in his pipes and governors at Winchester; and, if so, how he got on. It seemed to him that the great obstacle to the extension of this system of lighting would be this trouble with the gas supply, as he was under the impression that it could not be dealt with without taking the whole of the lamp off, and putting in a new mantle every time.

Mr. F. LIVESEY asked how Mr. Dexter proposed to treat these lamps in respect of the charge made to the parish. They were in some cases expecting them to be supplied at a lower price; but gas companies could hardly do this, considering the cost of the new mantles. It was right that gas managers should take up these mantles, and see what could be done in improving the illumination of the streets. The mantles, he was afraid, were not applicable to all situations—for instance, in a case where one of these lights was fixed under a railway bridge, the mantle had to be renewed every two nights.

Mr. DURKIN said he had had some little experience with these incandescent mantles in street lighting since May last. He was anxious to have a little practical experience before going very deeply into the matter, or before making any recommendation to the local authorities to alter the present system of lighting. He therefore took one of the lamps in the principal portion of the town, in which were fixed two 10-feet flat-flame burners. In their place, he introduced six of the "C" pattern incandescent burners, with mica chimneys; and certainly the result had been very marvellous, and the lighting effect was far and above what it was when the lamp was consuming the same quantity of gas with two flat-flame burners. These six burners were fitted with the bye-pass arrangement, which left a flash-light going throughout the time the lamp was unlighted. He had been troubled lately with naphthalene (which was no new thing in his district); but he had an arrangement outside the lantern for dealing with it. They introduced a T-piece, with a plug in it; and into this they poured some gasoline, which very soon cleared away any deposit of naphthalene in the service-pipes. Regarding his experience with the mantles, the lamps had been lighted 1542 hours; and they had had twelve renewals of the mantles, two of which were accidentally broken. Three of the chimneys had also been renewed, for he found that the mica chimneys were not kept perfectly concentric to the flame. They got burnt, and, of course, caused an obstruction to the light on the side which gave way through the immediate contact of the heat from the burner. With regard to the expense (he had not calculated anything for labour, but simply for mantles and chimneys), since May 4 last it had cost them

£1 os. 6d. Of course, this experiment had been quite at his Company's expense. There was very little shop-lighting in the immediate neighbourhood of these lights, where there was a tram junction, and the traffic was very congested at times. The lights had therefore been of great service to the public—very much more so than the two combination burners that were removed. The difficulties in the way of the general adoption of this system, however, was the deposition of naphthalene; and this had always been his trouble. The agent for the Incandescent Company at Southampton had obtained permission from the Corporation to put two "C" burners in a lantern that was made on the same principle as the "Lambeth" lantern, which was ventilated entirely from the top. No current of air was allowed to pass in from the bottom; and the cold air was admitted at the top, and the products of combustion passed out through the centre. He must say, however, that, comparing the two "C" burners close to the three 5-feet burners, they did not come out very well; but if the lamp was in an unsupported position, then the results were excellent. If the whole of the streets were lighted by this means, the effect would be very good; but he was sure that it required, like some other new-fashioned lights, a good deal of nursing. With regard to the question as to charging for these lights, at Southampton they were on the average meter system; and therefore any section of the town could be taken, and the average consumption obtained without much difficulty. He thought if incandescent gas lighting were carried out in sections in this way, there would be no trouble in the matter of charging; but when they came to contracting, possibly it might be found different. On the whole, so far as his experiment had gone, he was pleased with it.

Mr. A. E. Broadberry (Tottenham) described a small experiment which they had made with incandescent gas-lights by the entrance to the Tottenham Gas-Works. They fitted one of the "C" burners, with a bye-pass, to the gate lamp; one in an ordinary 14-inch street lantern; and one in a special lantern supplied by the Incandescent Gas-Light Company. The one in the special lantern was fitted with a mica chimney; and the others were tried with glass-rod chimneys. The gate lamp, in which they had a glass-rod chimney, had been very successful, and had given a good light; but the one in the special lantern, with the mica chimney, had to have two mantles fitted in the course of a month's experiment. One of the mantles was ruined by moths, which found their way into the lantern. As to the ordinary 14-inch lantern, they found the glass rods melted almost the first night they were put in; and as they melted, they curled over and destroyed the mantle. The successful lantern at the gate had been previously fitted with a two-flame burner; and they experienced no trouble with either the glass-rod chimney or mantle in that case. They had, however, discarded the lights, and returned to flat flames. The light, they considered, a good and bright one; but the trouble was too great for it to be of practical value.

Mr. Durkin asked to be allowed to say that the six burners to which he had referred were in an exposed position; but they had proved very satisfactory in a gale of wind.

Mr. Chapman supplemented his previous remarks by saying that the use of chimneys was altogether wrong. He did not think the lights could possibly answer with chimneys. In his case, they had only a circular glass, which stood some distance from the mantle, and in which there was a metal reflector with ventilator to it. They had not had the least trouble with these; and the lights remained as they were four months ago.

Mr. Helps said he had not had much experience with outdoor incandescent gas lighting; but he had had a little, and what little he had had, somewhat differed from the experience of Mr. Chapman. They had had one lamp, with ordinary mica chimneys, in use for about two months. The light was now just as good as the first day it was started; and the mantles did not show the slightest sign of deterioration. They were going to make rather a large experiment; but they had not been frightened into this by the advent of the electric light. As a matter of fact, they decided to carry out the experiment before they knew that the Croydon Town Council were going in for an electric lighting scheme; and he hoped to profit very much from Mr. Dexter's paper in making the experiment. Mr. May he thought touched the key-note of the whole business, in dealing with the difficulty with the flash-light in winter from naphthalene in the lamp services; and although he knew that to a certain extent obstructions could be removed with gasoline and other things as mentioned by Mr. Durkin, he did not think it would have the desired effect in a large percentage of cases. He did not quite understand Mr. Chapman as to the manner in which the lamp on Harrow Hill was governed. Mr. Dexter appeared to deprecate the use of governors entirely; but Mr. Chapman seemed to have two in use.

Mr. Chapman: We removed the top portion of the Borradaile burner, and left the governor in, putting the new one on top.

Mr. Helps remarked that experience differed here to a great extent. None of the members seemed to have had any winter's experience with these lights; and it would be interesting to have a further communication on the subject from Mr. Dexter at the spring meeting.

The President observed that he had tried the lamps for public lighting; and he had found no difficulty in adapting the mantle to the street-lamps. He was very pleased with it; but there was one point that struck him, and that was that no doubt photometrically it was a powerfal light. He had proved it to be three times more photometrically than the ordinary flat-flame burner. Photometrically, it was the cheapest light that one could obtain. It struck him, however, as being, like the arc light, kerosene, and other lamps, a very intense light; but he questioned whether they obtained three times the light as a public light—the diffusive light, he might call it.

Mr. Dexter, in reply, said he was glad the discussion had been of a fairly successful character; but, of course, it was a subject that was, comparatively speaking, an untried one, and he only hoped the few remarks he had been able to make would lead to the system being thoroughly tried, and not given up because, as one gentleman had said, one particular lamp in a certain situation happened to fail a greater number of times than was expected. The system must be worked out thoroughly; and if great care and attention were bestowed upon it, it would largely enter into public lighting arrangements in the future. He was very pleased indeed to find that Mr. Chapman's experience so closely confirmed his own; and he was glad that Mr. Chapman referred particularly to the new form of "C" burner, with the glass cup, as being the best for public lighting purposes. It had only recently been brought out; and he (Mr. Dexter) had not had the means of trying it. It had no chimney immediately surrounding the mantle; and it was undoubtedly a fact that this lamp did not give quite so high an effect photometrically as with the ordinary chimney. This was due to the fact that the draught was not so concentrated upon the mantle; but the important point of prolonging the life of the mantle was gained. In the lamps the Incandescent Company first brought out, they only used choked chimneys; and this was done to concentrate the combustion. This produced a much more intense light than if the ordinary cylindrical chimney was used. If, again, the chimney was enlarged (say) to the form of the dish or bowl, the lighting was undoubtedly reduced; at the same time the lessened draught upon the mantle prolonged its life. Mr. May asked what steps would be taken in the case of the lights being interfered with by deposits of naphthalene in the service-pipes. As a matter of fact, they were not troubled with naphthalene in Winchester to any extent. They experienced some difficulty with it in the large refuge lamps; but, without troubling to introduce a tee-piece such as Mr. Durkin referred to, and pouring liquids down the pipe in order to remove the naphthalene, he had adopted another method, which had proved effectual up to the present. He packed the columns perfectly tight with sawdust, and made the top of the column water-tight by putting on a piece of sheet lead, closely fitting the pipe. The column was thus kept warm; and the deposition of naphthalene was stopped absolutely. If there was any difficulty with regard to the removal of the deposit, there was no reason at all why the top portion of the burner should not be taken away from the body piece. The mica chimney, for instance, with the mantle and support. could easily be removed, and put on one side while the ordinary top was unscrewed. and the pipe forced in the usual way. He had had one or two cases of short supply to one of the lights, but not through naphthalene deposits. They were caused through water collecting in the service, which was in a defective condition, and that was cured by the removal of the burner, and putting on the weighted rubber disc referred to in the paper, to prevent the mantles being dislodged while the pipe was attended to. Mr. Frank Livesey had asked how one would deal with a local authority as to the question of price. He (Mr. Dexter) hardly knew how to reply to the inquiry, but thought it had been to some extent answered by Mr. Durkin. If the average meter system was in use, there should be no difficulty, if the lighting was taken up in sections. As far as the installation at Winchester was concerned, what they had done was to arrange with the Corporation that the Company should charge a certain fixed sum for the gas used in these lamps and for attending to them. He did not think it was a system that could be successfully left in the hands of the Corporation; but in order to make it work satisfactorily, it should be left to the Gas Company. It resolved itself into charging a certain sum depending upon the consumption of the burners. The charge could also be determined by the average meter system; and adding a fair amount for the mantles. He had only taken the mantles as a means to an end, and had not attempted to allow for them at the retail rate, and make a profit on them. Perhaps in his case, he had a special reason for pushing the system. For the last 16 or 17 years at Winchester, they had had nothing but wretched oil-lamps in the streets; and he was doing his best to get them out. The Corporation were working these lamps at a cost of £2 2s. or £2 5s. per annum, lighting all the year round; and he believed he would succeed in putting the incandescent lamps before them at a comparable rate. Mr. Helps had referred to the question of governors, and had drawn attention to the fact that he had spoken against the use of governors in any form, and also to the fact that Mr. Chapman was actually using two governors as a way out of the difficulty. What he (Mr. Dexter) intended to convey was this—that the governor sent out by the Incandescent Gas-Light Company was not found at all reliable; and he had had that governor removed, and had tried a thoroughly good one of the ordinary burner kind, by removing the nib. When a district was not under a great or a fluctuating pressure, it was hardly necessary to use a governor at all. There was one other point of some importance, referred

to by the President, as to the difference between the photometric and the practical value of the light. With regard to this, he did not know exactly how the value of the light could be determined as far as Winchester was concerned, because they had not any of the flat-flame burners in use. But tested against the oil-lamps (the rays of which were of a similar character to the flat-flame burner), the oil-lamps came out very bad indeed. As evidence of the practical character of the light, he stated that the public and the press of Winchester were unanimous as to the value of the light in all conditions of weather. To give satisfaction to both the public and the press was the most likely way of bringing about success.

Mr. S. W. DURKIN (Southampton) read the following short communication:—

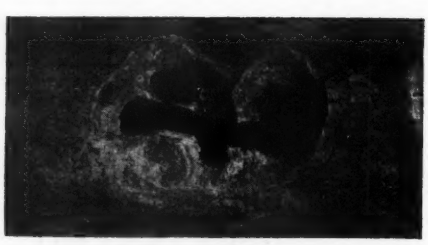
HOW AN ELECTRIC CURRENT INTRODUCED GAS INTO AN ELECTRIC CULVERT.

In introducing this subject, it will be as well to take a retrospective glance of the work carried out in Southampton by the contractors for the Electric Light and Power Company, under their Licence. Prior to the making of the culvert for containing the electric mains, a very amiable young man waited upon me to ascertain the depth of the gas-mains and service-pipes, and was desirous that we should, where necessary, have them put in such a position as not to interfere with their operations. This, he was informed, could be done at his employers' expense, provided that the usual conditions could be obtained of having a proper fall from premises supplied with gas back to the gas-main. However, we were not called upon to do much in this line. But we insisted that, where necessary, our pipes should be properly insulated. This the contractors did in their own way, especially where the service-pipes came close up to the floor of the culvert. But with how much success, in one instance at least, the sequel will show. I may state that during the progress of this work every gas-service was examined, and, where necessary, entirely renewed, so far as the electric culvert went. The Electric Company have now been supplying current for several years from a low-tension plant; and it appears to be a very good example of central station lighting.

Up till Oct. 16 last, the two underground systems for supplying each kind of artificial light had gone on without molesting each other, or disturbing persons or property. On the evening of the 15th of October, however, I am informed that there was a leakage on one section of the electric mains. On the following morning, the electric-light inspector went into the High Street to localize it. After opening up one or two of their covers, the man detected gas, and soon after telephoned to the gas-works for our inspector to come to his assistance. The latter, on arriving at the scene of action, had the whole of the traps over the section opened up; and as they went down the street, gas was scented more and more strongly, until they came very near to what proved to be the source of the mischief. I was sent for; and the question was what to do, in the emergency, to prevent any mishap and to stop the gas leakage.

The gas-main was under the kerb, so that the service-pipes were short in length. These latter I determined to strip and examine. Another precaution was to isolate the main. But, fortunately, this became unnecessary, as the second service we opened, and which passed under the floor of the culvert, revealed the cause of the mischief.

The electric mains, as previously stated, are laid for the low-tension system, and are strained up to bridges placed at intervals across the culvert. These mains are formed of copper bars about 1 inch by ¼ inch in section. The gas-service was supposed to be insulated by a stoneware tile, semicircular in section, embedded in Portland cement rendering on each side; but the centre was above the culvert floor. This insulation might have continued had the copper main kept in its original position; but, from some cause, it sagged (perhaps from a holdfast breaking), and rested on the insulating tile. Then the electric current, anxious to leave its copper-bound lodging, made a crater-shaped hole through the tile. [The fused portion of the tile and the perforated service-pipe were exhibited. The latter was evidently in good condition before the accident, and Mr. Durkin mentioned that it had only been in use something like three years.] The opening in the service-pipe is about 0·7 inch in area, and of irregular form.



The copper main was fused and fell asunder, dropping far enough away to prevent further short-circuiting. There was evidence of the gas having been lighted; there being a deposit of carbon found on the stone cover of the culvert. But for some reason the flame went out; the presumption is that it was for want of air to support combustion. It was very satisfactory that no explosion ensued. At the same time, this incident shows the culvert system to be one likely to lead to disaster when in close proximity to gas-mains in public thoroughfares. In this instance, there were 360 yards of culvert charged with gas. The damage was soon made good by those concerned; and a new form of insulator inserted, which, I trust, will prove more reliable than its predecessor. I leave my hearers to draw their own conclusions on the whole matter.

At the close of the communication,

The PRESIDENT said he did not think it was a subject which could be discussed. Although it was an uncommon experience at present, it might become a very common one in the future; and to be "forewarned" (as they were by the paper) "was to be forearmed."

Professor Lewes on the Production and Prevention of Smoke.—On Monday evening last week, an interesting lecture on the above subject was delivered by Professor Vivian B. Lewes, F.I.C., F.C.S., before the Institute of Sanitary Inspectors. In the course thereof, he expressed the opinion that the great solution of the smoke question would come from the universal employment of gaseous fuel; and he indicated the direction in which gas-stoves should be developed so as to secure the advantages of the present open fire without the trouble now inseparable from it. He acknowledged that the improvements effected in these stoves of late years had been very great; and he referred in appreciative terms to one devised by Mr. F. Siemens, which is much used on the Continent, in which, he said, the regenerative principle had been successfully applied. We shall notice the lecture at greater length in an early issue.

The Prevention of Scale in Boilers.—According to a paper on the above subject by Mr. J. Walter, if the water is fed into a boiler, together with small quantities of a solution of sodium carbonate, the deposit of scale is not prevented, but is localized more upon those parts which are nearest to the opening of the feed-water pipe. The probable cause of this is the difference between the temperature of the water in the boiler and that of the feed water. If, therefore, the temperature of the feed water were raised to the temperature of the boiler before coming in contact with the latter, all incrusting matters would be precipitated beforehand, and no scale could form upon the boiler-plates. To effect this result, a 6-inch tube is placed on low supports along the centre of the boiler at a distance of about 6 inches from the bottom. The front end of this tube is open; the back end closed with a blank flange. From the back end rises a vertical pipe reaching above the level of the water in the boiler, and loosely encasing the feed-water pipe. The water fed into the boiler does not, therefore, mix immediately with the water in the boiler, but passes through the narrow vertical tube, and subsequently through the wider horizontal tube. During this passage, its temperature rises to that of the boiler, and the incrusting matter is precipitated within the horizontal tube—no subsequent formation of scale upon the boiler plates taking place. Any of this precipitate washed out of the tube will be found to form a layer of fine sludge on the bottom of the boiler, or a granular coating on the sides, which is easily removed by a brush. The greater part of the precipitated incrusting matter will be found in the horizontal pipe, which after being cleaned is reinserted.

Institution of Junior Engineers.—The opening meeting of the 14th session of the Institution of Junior Engineers was held last Friday evening at the Westminster Palace Hotel. The retiring President, Mr. J. Wolfe Barry, C.B., took the chair at the commencement. His successor—Mr. Alexander Siemens, M.Inst.C.E.—subsequently delivered his presidential address. In the course of this, he said that few works of any importance could be carried out by the civil engineer without circumstances occurring which compelled him to exercise his ingenuity in suitably modifying his methods. Another factor which operated in a similar way was the constant development of new requirements in the course of the progress of civilization. Every novelty introduced brought in its train a fresh set of requirements, which made a demand on the resources and the versatility of the engineering mind. These problems constituted, in fact, one of the principal attractions of the engineering profession, and, in his opinion, entitled it to be considered as the profession most in keeping with the injunction that man should make Nature subservient to him. Generally, they might say that, in order to approach a problem with the most certain prospect of success, it was necessary (1) to define, as accurately as possible, the want that existed, or the particular object that was to be attained; (2) to be well acquainted with the scientific principles which came into play; (3) to know how the want was met, or the object attained in practical life; (4) to find out what proposals had been made by others in the same or in a similar case. Careful attention to these requirements would prevent much disappointment and waste of energy. His object that night was not to hold up to ridicule the endeavours of people who might be mistaken, who worked hard enough and earnestly enough in many instances to deserve a better fate, but to impress upon his hearers the necessity for making themselves thoroughly acquainted both with natural laws and existing practice.

THE GAS INDUSTRY IN THE UNITED STATES.

By Dr. H. Bunte, of Carlsruhe.

[It will be in the recollection of our readers that a tour to the United States was undertaken last year by Herr W. von Oechelhaeuser, of Dessau, and Dr. H. Bunte, of Carlsruhe, for the purpose of investigating the present state of the gas industry there. We have already given, in the current volume of the JOURNAL (*ante*, pp. 275, 324, 377, 428, and 469), a translation of the report of Herr von Oechelhaeuser on the subject, which was written mainly for the purpose of elucidating the economic conditions of the industry. The treatment of the technology of gas, as illustrated by United States practice, was left to Dr. Bunte, who communicated the results of his observations to the meeting of the German Association of Gas and Water Engineers held at Carlsruhe in June last. The following abstract translation has been prepared from the report of his lecture in a recent number of the *Journal für Gasbeleuchtung*. Before proceeding to his subject-matter, Dr. Bunte availed himself of the opportunity of paying a graceful tribute to the memory of Herr Kümmel, who was deputed to accompany Herr von Oechelhaeuser to the Chicago Exhibition as a deputation from the German Association. Herr Kümmel died shortly after his arrival on American soil.—ED. J. G. L.]

There have been two epochs in the history of artificial lighting during the latter half of the present century; and for both of these the United States are in the first instance responsible. One was brought to pass by the discovery of petroleum by Drake in 1859, on which ensued the flooding of the markets of the Old World with the produce of the Pennsylvanian borings; so that in countries where gas lighting was hardly established it was seriously threatened with extinction. Gas triumphed, however, as far as the towns were concerned; while the mineral oil brought the benefits of a cheap and clear light to the remotest hamlets. The second epoch was the time of the Electrical Exhibition at Paris in 1881, when Mr. Edison showed his incandescent lamps. Thence dates the unprecedented development of electric lighting—a development so rapid and widespread, that, in America at least, many have been led to prophesy the total displacement of gas for lighting purposes.

The electric light is especially prominent to the visitor to America; and gas appears to him to have everywhere fallen into desuetude. The unused standards, with their cross-bars, line the Broadway, New York, and appear to serve only as memorial crosses to a dead industry. Chicago seemed to Exhibition visitors prodigally provided with the electric light; and hundreds of arc lamps made the Park as bright by night as by day. But a more thorough inspection would have satisfied the visitor that there as elsewhere, the lighting needs of the great majority of the populace were satisfied by gas, which is used almost universally in ordinary dwelling and business houses in Chicago. For the public lighting of the main arteries of the town, as well as to subserve luxury, advertisement, and mere illumination, the electric light is used; but for little else. Petroleum is found by experience to be too dangerous a source of light for dwellings where wood and tapestry are much favoured. The gas engineer on his tour would further notice the immense gasholders in all the large towns, and the constructing operations in progress at the gas-works; and he would deduce therefrom that a healthy development continues in the gas industry on that side of the Atlantic.

The extent to which gas is used in America may be fairly estimated from the following statement of the production and price in twenty-four towns in 1893:—

Town.	Population.	Approximate Make in 1893.	Make per Head of Population.	Price per 1000 Cubic Feet. (Dollar=4s. 2d.)
		Thousands.	Cubic Feet.	s. d.
Cleveland	300,000	599,680	1999	3 4
Boston	500,000	1,178,000	2356	4 2
Milwaukee	250,000	574,690	2299	4 2
Pittsburgh	300,000	419,770 *	1399	4 2
St. Louis	550,000	1,099,400	1999	4 11
Buffalo	280,000	388,480	1388	5 0
Baltimore	500,000	1,499,200	2998	5 2½
New York	1,500,000	11,301,300	7534	5 2½
Brooklyn	900,000	3,436,300	3818	5 2½
Chicago	1,500,000	5,149,160 *	3433	5 2½
Providence	135,000	516,434	3825	5 2½
Washington	230,000	799,568	3478	5 2½
Denver (Col.)	130,000	299,838	2306	6 3
Detroit	240,000	139,924	583	6 3
Philadelphia	1,200,000	3,583,220	2988	6 3
Kansas City	135,000	211,885	1568	6 8
Minneapolis	185,000	324,813	1755	6 8
St. Paul	150,000	249,865	1663	7 1
San Francisco	300,000	1,239,610	4132	8 4
Helena	14,000	19,989	1427	10 5
Salt Lake City	65,000	49,973	769	10 5
Leadville (Col.)	16,000	15,991	1017	11 5½
Sacramento (Cal.)	30,000	59,967	1999	12 6
San José (Cal.)	20,000	24,986	1250	12 6

* Exclusive of natural gas consumed.

Sixteen companies supply gas to the sister towns of New York and Brooklyn, owning in the aggregate 22 works and 15 distributing stations. The appropriate make of gas in 1893 in the two towns was 14,779 million cubic feet, of which New York City accounted for 11,340 millions.

The competition of petroleum and electricity has during the past decade effected a complete revolution in the gas industry in America; impressing on it methods peculiar to the country. The coal gas familiar to the Old World is made, but in smaller quantity than water gas. The number of water-gas installations is about 500. The precedence of water gas cannot be attributed to a lack of gas coal, since in most States there are valuable deposits of rich coal at the disposal of the gas engineer at a cheaper rate than is current in many countries in the Old World. Anthracite is plentiful in Pennsylvania only, and is of small importance by the side of the general abundance of ordinary coal. It may be concluded that the success of water gas is in no way due to the absence of good gas coal in the United States, but to the prevalence and cheapness of oil (which can be used to impart to the gas an illuminating value of 25 to 30 candles), and to the economy in labour inherent in water-gas processes.

The quantity of crude oil raised in the United States in the year 1892 was something like 2000 million gallons; being about double what it was ten years earlier. After making due allowance for the amount exported, more than two-thirds of the bulk of oil raised remains for home consumption. A considerable proportion of this is used as fuel in boiler furnaces; and upwards of 30,000 gallons were daily consumed under the boilers at the Chicago Exhibition. The chief oil-fields are in the States of Pennsylvania, New York, Ohio, and West Virginia. The transport of the crude oil is effected by pipe-lines, which traverse distances of hundreds of miles, and unite the chief ports directly with the oil-fields. The oil is for the most part distilled at immense refineries in the neighbourhood of the ports. The products of the distillation vary according to the nature and source of the oil. Pennsylvanian oil gives about 10 per cent. of light naphtha (benzene), 75 per cent. of burning oil (kerosene), 6 per cent. of lubricating oil, and 4 per cent. of residuum; while the percentages of these products from Ohio oil are respectively 15, 35, 45, and 2. There is a loss on distillation of about 5 per cent. in the case of Pennsylvanian oil, and of 2 per cent. in the case of the Ohio petroleum. Burning oil is the only product of petroleum that is very extensively exported. The other products remain in the country, and, being comparatively valueless, are used as fuel and for carburetting water gas.

The oil-fields of the Union being now the chief source of raw material for the American gas industry, a few particulars of their situation and working will be appropriate. The chief producing area has tended during recent years to shift westwards; Pittsburgh being at present the centre of activity. The district around is studded with "derricks," or boring-towers, which for convenience have their parts interchangeable. The oil either flows naturally from the finished wells or is pumped up sometimes from depths of as much as 900 yards. The crude oil is allowed to stand in settling-vessels, so as to deposit silt and water. It is then measured, and conveyed by means of pipe-lines to storeage-tanks, whence it is pumped as required to the refineries, which are often some hundreds of miles distant. Where the oil flows from the wells of its own accord, natural gas is to be found also. This is analogous to the oil in chemical composition, and consists chiefly of methane, the first member of the paraffin series of hydrocarbons. The gas has a very high heating value, and is applied most extensively in the neighbourhood of Pittsburgh, for both technical and household purposes. Notwithstanding the prevalence of excellent coal in the district, the steel and glass works of the Alleghany and Monongahela Valleys use natural gas almost exclusively, on account of the purity of the flame, and the great convenience attending its employment. Natural gas enters into competition with artificial gas in Pittsburgh, Ohio, and Indiana, but almost solely for heating purposes. Up to the present, it has scarcely been used for lighting on the incandescent principle. Even in Pittsburgh, where the electric light is also well exploited, there are four gas companies, apparently thriving well. Natural gas is also led to Chicago from the Indiana springs, and is extensively used both for boiler installations and household firing.

Illuminating gas is produced from petroleum, whether directly from the crude oil, from the very volatile naphtha or benzene, or from the residual oils of the refineries where burning oil is the staple product. The storeage of large quantities of these inflammable oils at gas-works requires considerable precautions. The receptacles are of boiler-plate; and they are placed sometimes above, sometimes below the surface of the ground. In the former case, each is surrounded by an enclosed reservoir, capable of holding the entire contents of the tank in the event of an accident to it. The greatest care also is exercised in the transport of the oil on the works; the arrangements in the large towns being admirably adapted to ensure safety. In all water-gas processes, non-luminous water gas is first produced, and this is afterwards carburetted with petroleum. This operation may be carried out in two essentially different ways—one constituting the direct or generator process, and the other the indirect or retort process.

The number of water-gas "systems" is legion; but though

some differ considerably from either type, they may, on the whole, be ranged under two heads. The Lowe system of the United Gas Improvement Company of Philadelphia is typical of the generator system; and the Wilkinson process of Messrs. Bartlett, Hayward, and Co., of Baltimore, of the retort system. The general arrangement of these water-gas installations need not here be given in detail. Common to all systems is the formation of water gas in a tall furnace filled with fuel raised to incandescence by a blast. The fuel may be either anthracite, gas coke, or else smithy coke; the first-named material being generally too expensive. The consumption of fuel and steam varies very greatly in different works. The producer gas formed in the blowing-up process is very commonly wasted. The blowing-in of steam, with the formation of water gas, goes on, alternately with the blowing-up process, in periods of from ten to twelve minutes.

With the Lowe (Humphreys-Glasgow) system, any kind of oil can be used. It is injected during the period of water-gas making, either directly into the generator or into a separate chamber set with fire-proof bricks which are at a white heat. Decomposition of the oil ensues, the products mix with the water gas, and an illuminating gas is formed. The crude gas may conceivably have very varying lighting power. In regular working, however, the variations become small; and in the holder a uniform saleable mixture is obtained, of any desired quality from 25 to 30 candles. The crude gas passes from the generating plant to the condensers and scrubbers, where a small quantity of almost valueless tar is deposited. It then goes to holders, from which it is drawn in an even stream through the purifiers to the distributing holders. Lime is almost solely used for purifying water gas; oyster-shells being generally the raw material for the lime in America. Air is often mixed in small proportion with coal gas for purification by oxide of iron.

With the second type of water-gas apparatus, represented by the Wilkinson system, the pure water gas is first collected in holders, and then passed, with vapours of petroleum naphtha, through the "illuminator." This is a vessel of sheet iron, containing a number of inclined plates heated from beneath by steam. The naphtha trickles downwards over these plates; and, as it vaporizes, mixes with the water gas going through the vessel. The outflowing gas has a fairly high lighting power; but the flame has a large blue core, and, moreover, the hydrocarbons are apt to separate from the gas by condensation. The crude lighting gas is therefore passed through incandescent retorts, arranged and heated similarly to coal-gas retorts, in order to fix it. The fixing mainly consists in the conversion of a portion of the petroleum hydrocarbons into aromatic products such as benzol; and the gas, after being so treated, is more permanent, and considerably enhanced in light-giving value. A uniform product, having an illuminating power of 23 candles and upwards, is thus obtained. The exact changes that occur in the fixing process, as well as in the decomposition of oil in the direct process, are unknown at present; but they are forming the subject of investigation.

From a technical standpoint, the apparatus of each system has been carefully worked out; and in the first especially there is great simplicity, as well as economy of labour. It is generally reckoned that a water-gas plant requires only two-fifths of the staff necessary for the production of a similar volume of coal gas. This economy in labour tells greatly in favour of water gas under the labour difficulties and the high rate of wages prevalent in the United States. The cost of water gas does not, however, appear to be thereby brought below that of coal gas, when the light yielded is taken as the basis of comparison; and therefore other reasons must be found for the preference of water gas. The advantages it presents may be summarized as follows: It has a high illuminating power; it is rapidly made; the plant is easily put in and out of action; the capital outlay and the cost of maintenance are small; few workmen are needed; and the price of coke is maintained by the quantity for sale being restricted.

The choice of processes is largely influenced by local conditions, and the market prices of the different petroleum products. When naphtha is cheap, it is used in both systems; but at other times the generator plan has the advantage in a greater freedom of choice of material. The composition of the gas made by the two systems is similar; but it differs essentially from coal gas, as will be seen by the following table:—

Constituent.	Water Gas.		Coal Gas.	Natural Gas of Kokomo (Ind.)
	(*a*)	(*b*)		
Methane (CH_4) . .	17	24	35	93 per cent.
Hydrogen (H) . . .	36	32	48	1 ,,
Carbonic oxide (CO) . .	28	25	8	
Heavy hydrocarbons (C_nH_m)	15	15	5	about 6 ,,
Carbonic acid (CO_2) . .	4	4	4	
Nitrogen (N)				

(*a*) By the Lowe process. (*b*) By the Wilkinson process.

The large proportion of the poisonous carbonic oxide in water gas is a great disadvantage; and at one time the distribution of water gas was prohibited in the New England States. The prohibition has, however, long since been withdrawn; and the high percentage of carbonic oxide counts as no impediment to the distribution of water gas while electric currents of 500 and 1000 volts are tolerated in place of safe low-tension currents.

The price of gas in the towns of the East, as may be seen from the table previously given, is not much above that of many European towns, although the illuminating power is considerably higher. In the Western towns, gas coal has to be procured from a distance; and the price of gas is therefore very high. The American system of dealing with the competition of the electric light has been to make very rich gas; and the demand for the latter is really the key to the success of water gas in the United States.

The question how far the American methods may influence the European industry, would appear to be answered by the scarcity of petroleum in Europe. But cheap water transport may place petroleum in many European towns at a lower price than it bears in many inland American towns. The water-gas process is already established in London; and plant is being erected in other English towns. The high duty on petroleum in Germany prevents its use there. A disadvantage of the water-gas process is the absence of bye-products. The importance of the coal-gas residual products in commerce may be instanced by the fact that spent oxide yields the bulk of the potassium cyanide used in America and Africa for the extraction of gold by the new M'Arthur-Forrest process. High-power illuminating gas has no longer a *raison d'être* since the introduction of the incandescent or Welsbach system of lighting, though this system opens up a new field for uncarburetted water gas. The minerals monazite and thorite, which are used for preparing the fluid in which the Welsbach mantles are immersed, are very plentiful in America; but up to the present,* incandescent lighting has been neglected there.

THE DEGREE OF INCANDESCENCE OF LAMPS.

In a recent number of the *Comptes Rendus*, there was a communication on the above subject by M. Crova. The author first of all explained his method of determining the luminous intensity of a light, and then proceeded to show how it could be easily applied in ascertaining the conditions under which lamps give the best results. In the case of an arc lamp consuming from 1509 to 1660 watts, the degree of incandescence was from 1·5 to 1·7. For a 16-candle power lamp, the figures varied from 1·05 to 1·25, according as the lamp was more or less forced. Taking the Welsbach burner, he arrived at the following figures as the result of a considerable number of determinations:—

Luminous Intensities. Carcels.	Degrees of Incandescence.	Gas Consumption per Hour. Litres.	Gas Consumption per Carcel. Litres.
4·42 ..	1·30 ..	93·00 ..	21·00
5·23 ..	1·41 ..	105·00 ..	20·00
5·35 ..	1·47 ..	102·00 ..	19·00

It will be seen from these figures that the photometric power increases with the degree of incandescence; and this is in accordance with the principles governing the emission of radiations from incandescent bodies. As the consumption of gas per hour increases, the degree of incandescence, which is slight at the outset, continues to augment, as does also the photometric power, up to a certain limit, beyond which an increasing proportion of gas burns uselessly—that is, burns without assisting in heating the tissues of the refractory earths which constitute the mesh of the burner. It is therefore of advantage to raise the Welsbach mantle to a degree of incandescence which it will not be able to surpass whatever may be the consumption of gas.

Similar experiments may be made with the various forms of high-power burners; and the results arrived at will afford clear indications of the best conditions of working. It is quite otherwise, however, with gas consumed by the aid of an ordinary Bengel burner. In fact, in the Welsbach and similar burners, the quantity of refractory material in the lamp is constant; and the maximum yield of light corresponds to the highest temperature it will attain with a Bunsen burner. In the Bengel burner, on the contrary, a certain proportion of the gas is consumed exteriorly and interiorly to the cylindrical mass of gas which issues by the ring of holes, without deposition of carbon, with the production of a bluish flame, negligible from a photometric point of view. The high temperature produced by this combustion without useful light raises to incandescence the molecules of carbon dissociated from the hydrocarbons which are contained in the mass of gas between the two surfaces of combustion, and are the true source of light. The quantity of incandescent carbon which emits light is only a fraction of the total amount contained in the gas in process of combustion; and the lower the flame, the smaller is the proportion. If the flame is reduced to a size sufficiently small, the gas burns blue without producing any useful light. With an increase in the consumption of the burner, the relative quantity of dissociated carbon is augmented; the degree of incandescence diminishes slightly; and the yield of light rapidly increases to a maximum, which is attained the moment the flame becomes smoky. A similar result is obtained with the Carcel standard lamp when

* It may be pointed out that Dr. Bunte's report was written some months ago.—ED. J. G. L.

the consumption is varied by raising the wick. With a Bengel burner, the following results were obtained:—

Luminous Intensities. Carcels.	Gas Consumption per Hour. Litres.	Gas Consumption per Carcel. Litres.
0·2	56	280
0·4	78	195
0·6	95	158
0·8	108	135
1·0	120	120
1·2	131	109

Beyond 131 litres per hour the flame became smoky.

It results from the preceding considerations: (1) That, by increasing the amount of the combustible burnt per hour, the quantity of light emitted is augmented; but the degree of incandescence slightly diminishes up to a maximum yield which should not be exceeded. (2) That, in lamps in which the refractory substance raised to incandescence has a fixed value, independent of the consumption of the combustible, the maximum yield corresponds to the minimum amount of the combustible which must be burnt in order to obtain the maximum degree of incandescence.

Piping Natural Gas to Chicago.—For the purpose of conveying natural gas from Greentown to Chicago, a distance of some 115 miles, two mains 8 inches in diameter have been laid. The gas comes from the wells at a pressure of 315 lbs. per square inch; and this is increased to 600 lbs. per square inch by pumps, at which pressure it enters the mains. The pipes are of wrought iron, and have proved to be very tight. The loss of pressure in three days, when closed at each end, after having been previously pumped up to 600 lbs. per square inch, is stated to have been less than 1 per cent. The capacity of each main is about 700,000 cubic feet per hour, delivered at Chicago.

The Transactions of the Societe Technique.—We have received the volume of Transactions of the Société Technique du Gaz en France for the present year. It contains the report of the proceedings at the twenty-first annual Congress, held at Nîmes on the 16th and 17th of May last, under the presidency of M. Mallet. The communications were less numerous than usual; and their nature has been already indicated in the JOURNAL. The text is accompanied by six folding plates; and in an appendix is given M. Crova's interesting discourse upon photometry. M. Victor Delahaye continues his useful review of legal cases affecting the gas industry; the rest of the matter in the volume consisting of the lists of members of the Society, the rules, and the reports of the Committee in regard to the awards of the Society's prizes for papers, &c.

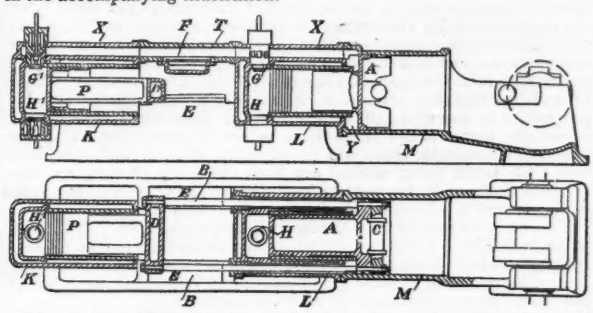
Death of an Adelaide Electric Lighting Agitator.—Early in the present year, reference was made in our "Electric Lighting Memoranda" to the wanderings of a certain Mr. George Anderson, a member of the Adelaide City Council, in search of information respecting the electric light. We learn, from a letter which has just reached us, that Mr. Anderson died suddenly a few months ago from apoplexy. Deceased had a rather eventful career. It appears that he went to Australia and took up his abode in Adelaide about thirty years ago, and was for a long time Manager of the Gas Company. His business methods were not altogether satisfactory, and, moreover, while he was in authority, one of the holders was wrecked by an explosion; so that eventually he was "permitted to resign." He then undertook the superintendence of the erection of gas-works at Broken Hill; and subsequently he was elected a member of the City Council. In this capacity, he worked incessantly in the furtherance of a scheme of electric lighting for the city; even visiting this country in pursuit of his inquiries. Though he was a strong opponent of the Gas Company, and at the time of his death was engaged in a controversy with their Secretary (Mr. J. Evans) as to the use of cannel, he once held a number of shares in the concern; but these were, we believe, settled on his second wife, from whom he was divorced.

Gas and Electric Lighting Affairs in Brussels.—We learn from our Brussels Correspondent that, as the result of repeated applications by the citizens, and in view of the small number of customers which the electric light undertaking has secured, the Communal Council has decided to reduce the charge for electricity to 8 c. per hectowatt for private consumers, and to 6 c. per hectowatt for those who take a large quantity. It will be interesting to watch the development of the industry under these new conditions. With regard to gas supply, we learn that the double-index meters in use in the city have been the cause of frequent complaints; and, as a consequence, the Gas Committee have determined to make the price uniform for both day and night gas. At present the charge is 10 c. per cubic metre, or 2s. 3d. per 1000 cubic feet, for the former, and 14 c., or 3s. 2d. per 1000 cubic feet, for the latter. The new rate has not yet been fixed. The matter is one of considerable importance to the city, as each reduction of 1 c. means a diminution in the revenue to the extent of 160,000 frs.; and hitherto experience has not shown that reductions have been followed by those large compensating increases in consumption which certain optimists have prognosticated. The Committee have also arranged to bring into service shortly some automatic prepayment meters, which are specially valuable in connection with the supply of gas for cooking or heating purposes.

REGISTER OF PATENTS.

Gas Motor Engines.—Hamilton, J. H., of Sandiacre, Derbyshire. No. 21,120; Nov. 7, 1893.

This invention of a tandem engine—an improvement on patent No. 6015 of 1890—is shown in longitudinal sectional elevation and plan in the accompanying illustration.



Two motor cylinders K L are placed in line with eacn other, and with another larger cylinder M, in which works the enlarged end of the front piston A. The latter carries the gudgeon or pin C, to which is jointed the connecting-rod. It has also secured to it the side-rods B; the latter preferably in the horizontal axial plane, as shown. The rods pass backwards alongside the motor cylinder L, and are connected at their rear ends to the crosshead D, cast in one with the back motor piston P, or else secured to it. The ends of the crosshead work in slots in the sides of the cylinder K, when the latter is long enough to bolt to the back end of the cylinder L; but the patentee prefers to cut away the upper front portion of the cylinder, or else make the cylinder short, as shown, and provide guides (as at E) for guiding the front end of the piston P.

The air inlet-valve—of the kind described in the former patent—is shown at F; a passage X conducting the air to the cylinders K L M. The admission-valves for gas and air are at G G^1; and the exhaust-valves, at H H^1. The former are arranged as described in patent No. 4189 of 1892; and both admission and exhaust valves are operated from one side shaft through cams and levers in the usual way—the cams being arranged so that, when one piston is making its explosion stroke, the other is making its suction stroke.

The action of the engine is as follows: Suppose the pistons are commencing their forward stroke, as shown, and that this is the explosion stroke of the back piston P and the suction stroke of the front piston A. Air is then drawn in through the valve F; part of it passing through the valve G to the front motor cylinder, and part to the annular space Y behind the enlarged end of the piston A. On the return stroke (the exhaust-valve H^1 of the cylinder K being open and the admission-valve G^1 being also opened), after the pistons have made a portion of the return stroke, the air in the space Y is first slightly compressed—say, to 2 lbs. per square inch—and then passed through the valve G^1 into the cylinder K, mixing with, and expelling the products of combustion therefrom. The exhaust-valve H^1 is not closed till after the crank has passed the dead-centre; thus allowing time for the pressure in K and the space Y to fall nearly to atmospheric pressure. The gas-valve of the cylinder K is now opened; and the same series of operations are repeated, only that the front cylinder now makes its explosion stroke, and the back cylinder its suction stroke. There is thus an explosion at each forward stroke when working at full power.

Preparation of Cyanogen Compounds.—Hood, J. A., of Shepherds Bush Road, W., and Salamon, A. G., of Fenchurch Avenue, E.C. No. 21,239; Nov. 8, 1893.

These improvements relate to the preparation of compounds of cyanogen, and more particularly to cyanides and oxy-cyanides or cyanates of the alkalies and alkaline earths or other bases.

It is well known, the patentees remark, that, under suitable conditions, ammonia and carbon bisulphide may be caused to react according to the equation: $CS_2 + NH_3 = H_2S + HCNS$. It is further known that, in the presence of suitable bases—such as lime manganese, or ammonia—sulphide and sulpho-cyanide of the bases are formed. The existence of many chemical analogies between carbon bisulphide (CS_2) and carbonic acid (CO_2) would suggest the possibility that, under suitable conditions, carbonic acid (CO_2) would react with ammonia (NH_3), and that such reaction would be expressed by the equation: $CO_2 + NH_3 = H_2O + HCNO$, in which oxygen takes the place of sulphur in the equation first stated above, and as a result gives rise to the formation of water and cyanic acid. The inventors claim that they have practically proved the correctness of this assumption, and have further found that, under suitable conditions, and in the presence of suitable base or bases, the oxy-cyanide of the base may be formed, instead of the sulpho-cyanide which results when carbon bisulphide is employed. It is known that the alkali sulpho-cyanides—*e.g.*, sodium sulpho-cyanide—may be caused to part with the contained sulphur when heated with a reducing body (such as zinc or lead), in which case the sulpho-cyanide is converted into cyanide, according to the equation: $NaCNS + Zn = NaCN + ZnS$. By following the analogy above quoted, it might be expected that the oxy-cyanide, when similarly heated, would undergo the following decomposition: $NaCNO + Zn = ZnO + NaCN$. The patentees have proved this to be true under proper and variable conditions; and hence they have proved the possibility of producing from ammonia and carbonic acid, in conjunction with a suitable base and reducing agent, the cyanide of the base.

When preparing the cyanide of any particular base, the reagents ammonia and carbonic acid may be employed separately—the former as a liquid which may be volatilized as required, and the carbonic acid as a gas. Or the two may be employed together as a solid carbonate of ammonia and volatilized as required. As above shown, these reagents only tend to form an oxy-cyanide; and a reducing agent is further

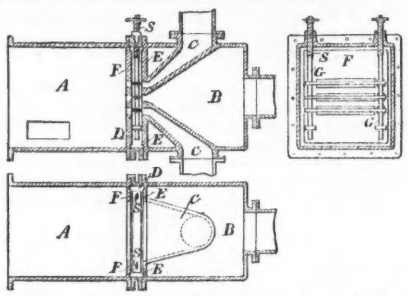
required to take the oxygen from the oxy-cyanide, and form cyanide. For this purpose, one or other of the ordinary reducing materials is employed—such as a metallic zinc, manganese, or lead. Or the equivalent of these metallic reducing agents—viz., the oxide of carbonate—may be used, with the addition of solid carbon or other suitable solid or liquid carbonaceous material.

It is not absolutely necessary, in order to bring about the reaction, that carbonic acid be employed *per se;* for the base itself that it is desired to employ may be in the form of carbonate, thus simplifying the requirements for the reaction to ammonia, a carbonated base and a metallic reducing agent, or their equivalent. Or it may be better to employ two carbonated bases, so as to supply the carbonic acid from one base to form the cyanide of the other base. Thus, to form cyanide of sodium, ordinary carbonate or bicarbonate of soda in suitable proportion is incorporated with a metallic reducing material, such as metallic zinc. If the mixture be heated to dull redness with the vapour of ammonia, there will result oxide of zinc, and cyanide of soda; the latter being washed out from the oxide of zinc, and the solution dealt with for purposes of commerce—being purified from contaminated zinc by crystallization or other suitable means.

This reaction may be thus theoretically expressed: $NH_3 + Na_2CO_3 + Zn = NaCN + NaHO + ZnO + H_2O$. From this it will be seen that only half the base goes to form cyanide. To complete the reaction, sufficient carbonic acid may be supplied by passing the gas over the heated mass simultaneously with the ammonia.

Mixing Gas and Air for Gas-Furnaces.—Axdorfer, G., and Sass, C. F. H., of Hamburg. No. 22,681; Nov. 25, 1893.

The principal object of this invention is "to afford a more rapid and intimate mixing of gas and air [in furnaces] than is possible with the devices heretofore employed;" and by reason of this uniform mixing, "not only is the occurrence of pointed (blow-pipe) flames completely obviated, but a smokeless combustion is also ensured."



The improved apparatus comprises a mixing chamber D, arranged between the combustion or igniting chamber A and the gas and air supply forming nozzles B and C respectively. The lateral walls E and F of the chamber are provided with slots, which correspond to the orifices of the gas and air inlet-nozzles, which have also the form of slots. In the mixing chamber is a grate-slide G, adapted to be adjusted by screws S, and having bars which cover the slots in the walls E and F more or less, according to their adjustment, in order to regulate the quantity of gas and air which passes out for combustion. As the gas and air, on leaving the nozzles, impinge against the bars of the slide and against the opposite wall of the mixing chamber, strong whirling movements are produced in the latter, so that the gas and air become intimately mixed. The mixture then passes through the slots in the wall F of the mixing chamber into the combustion chamber A, which, in the case of steam-boilers, may form the front part of the furnace—the heating flame spreading from the combustion chamber freely in the furnace.

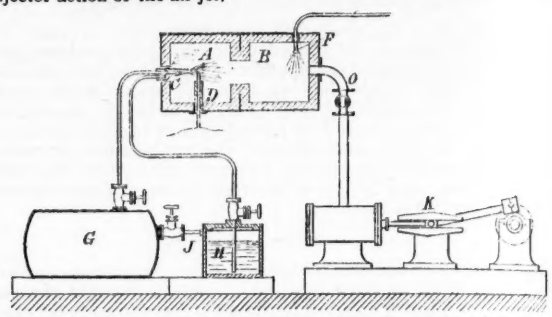
Outlet-Valves of Gas-Engines.—Stroh, L., of Frankfort-on-the-Main. No. 23,175; Dec. 2, 1893.

According to this invention, an eccentric, wedged on the crank-shaft of the engine with a convenient leading-angle, is provided at its circumference with a number of worms, catching into a worm-wheel with a double number of teeth, and revolving the same. The worm-wheel is situated in an eccentric ring jointed to the frame by an arm; and it stands through a spindle in connection with a curve disc, against which a slide (also situated on the eccentric ring, and carrying a pivot) is constantly pressed by a spring. In consequence of the double transmission between the eccentric and the worm-wheel, the slide is pushed once forward and backward while the crank-shaft is making two revolutions; the curve disc being so placed that, in the high position of the eccentric, the slide is in one of its extreme positions, and stands still for some time, while the motion of the valve takes place only when the eccentric passes through the lower half of the circular course. Accordingly, the pivot will push against the valve-rod only at every second revolution of the crank-shaft, and raise the outlet-valve.

Generating Elastic Fluid under Pressure for Performing Work.—Abel, C. D.; communicated from the Gas Motoren Fabrik-Deutz, of Deutz, Germany. No. 23,828; Dec. 11, 1893.

According to this invention, elastic fluid under pressure—available for performing work—is generated by effecting the combustion of liquid or gas with air within a closed chamber to which steam or water spray is admitted, so that the introduced steam, or the steam resulting from the water spray, mixes with the hot combustion gases under pressure, producing a compound elastic fluid under pressure that is led off from the chamber to the motor engine or other apparatus in which it is to be utilized.

The illustration shows a sectional diagram of the apparatus. A B is the closed chamber partly or wholly lined with refractory material (as shown), and which has at one end an injector C for the introduction of air and liquid or gaseous fuel, and at the other end a nozzle or rose F for the introduction of steam or water spray, and a pipe O for conducting away the elastic working fluid produced. The injector C has a nozzle through which air issues, supplied from the reservoir G containing air under pressure, and a nozzle through which flows combustible liquid, supplied from the reservoir H containing such liquid under pressure. The pressure within this vessel may be maintained either by connecting it, by means of a pipe J, with the air pressure-reservoir G, or by forcing in the liquid by a pump. The reservoir H may also be subjected only to atmospheric pressure, if the air pressure employed be sufficiently high above that existing in the chamber A as to cause the liquid to be drawn in to the required extent by the injector action of the air-jet.



The mixture of air and combustible fluid thus injected into the chamber A is there ignited and maintained in continuous combustion by the device D; the chamber A being made sufficiently large for the purpose. The resulting hot combustion gases pass into the compartment B, and mix with the steam or water spray entering through the nozzle F. If water spray be employed, this is instantaneously converted into steam by the heat of the gases; while if steam be employed, it becomes superheated to a corresponding extent. By this means an elastic working fluid is produced (composed mainly of carbonic acid, nitrogen, and steam), which is led off through a pipe O to a steam-engine K or other motor, such as a steam-turbine.

By correctly proportioning the quantity of steam or water spray supplied, the temperature of the combustion gases can be so reduced that the elastic fluid can work in an engine cylinder, without requiring this to be cooled. In this way, the losses of heat caused in ordinary gas motor and caloric engines by the use of cooling water, and by the heat passing away with the hot escaping gases or air, are avoided.

By the means described, the elastic working fluid may be readily regulated, say the patentees, so as to work at a higher or lower temperature; and by providing either a throttle valve on the supply-pipe O of the engine, or by the use of variable expansion gear, the motor engine can be regulated so as to give off any desired power, as the continuous production of the hot working fluid in the chamber A B is independent of any variation in the quantity of the working fluid taken off in a given time—the chamber being of a sufficient capacity to afford the necessary store of such fluid.

Hydraulic Main Valves.—Walker, C. C., of Donnington. No. 24,019; Dec. 13, 1893.

Valves constructed according to this invention are more especially designed for controlling gas-works hydraulic mains; but they are applicable also for use with washers, scrubbers, or other apparatus where it is necessary to deal with liquids of different specific gravities—for instance, tar and ammoniacal liquor—while at the same time preserving any desired depth of liquid in the apparatus.

Fig 1

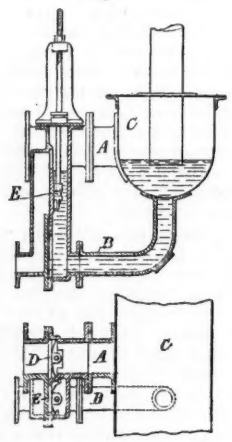


Fig. 2

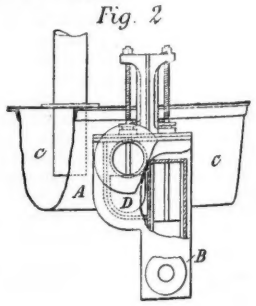


Fig. 1 is a section and horizontal section showing the invention applied to a hydraulic main. Fig. 2 is a side view.

There are two passages or openings in a valve A and B, one at a higher level than the other. The upper passage leads from the side of the hydraulic main C, and allows the gas and liquor to pass through from the hydraulic to the foul main. The passage is controlled by a slide D (preferably of ⊔ shape), working against a valve facing in A, and capable of being raised or lowered to give any desired elevation of the lower part of the passage, and consequently any desired seal on the dip-pipes of the hydraulic main. The slide can also, when desired, be made to close the passage entirely, so as to prevent gas returning from the foul main. The front of D is surfaced so as to work closely against the surfaced side of the faces against which it bears; and it is

securely held in position close up against the faces by a spring bearing upon its back, as shown in the horizontal section. This ensures a perfectly gas-tight joint for all positions of the slide. The passage B, at the lower level, is connected with the bottom of the hydraulic main C (which may be effected by means of a bend or elbow pipe, as shown in the vertical section), and allows the tar to run away continuously and automatically. The level of the tar in the hydraulic main is regulated by a slide E, working against the surfaced faces of the division-piece in the valve; the top of the division-piece being level with, or below the bottom of, the hydraulic main. The slide E can be raised or lowered to a greater or less distance above the top of the division-piece, to suit the specific gravity of the tar deposited in the main; and the main can be flushed out by completely lowering the slide E.

Gas and Oil Engines.—Abel, C. D.; communicated from the Gas Motoren Fabrik Deutz, of Deutz, Germany. No. 408; Jan. 8, 1894.

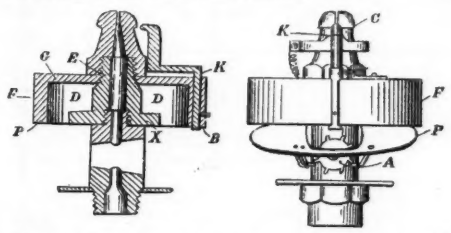
This invention relates to improvements in apparatus for supplying combustible fluid under pressure to four-stroke cycle gas or oil motor engines.

In patent No. 5273 of 1890 was described an arrangement whereby a flexible diaphragm on a chamber communicating with the gas or air supply or with the mixing chamber of the engine, was made to control both the combustible fluid supply-valve and the discharge-valve of the engine. The present invention relates more particularly to oil motor engines; and it has for its object to control the oil supply, independently of the discharge-valve, by a separate flexible diaphragm communicating with the air supply or the vaporizing or mixing chamber, whereby, on the one hand, a very ready means of regulating the speed of the engine is obtained, and, on the other hand, it is rendered possible to place the device controlling the oil supply, together with the oil reservoir, at any desired point away from the engine, which is of advantage when inflammable oils (such as benzene) are employed.

Although the improvements described in this specification are mainly applicable to oil motor engines, yet they are also applicable to engines worked by elastic combustible fluid, such as gas, in which case the oil-pump would simply be replaced by a valve on the gas-admission pipe.

Lighting and Extinguishing Device for Gas-Lamps.—Brück, S., of Berlin. No. 16,695; Sept. 1, 1894.

The patentee remarks that, "in electric lighting devices for gas-lamps which operate by the gas-cock being opened and closed by an electro-magnet, and by the contact at the burner outlet being repeatedly interrupted to produce an igniting spark, it has hitherto been necessary to intercalate an induction roller (self induction, extra current) in the electric circuit. It is true that in the two electro-magnet bobbins of these devices an induction current (extra current) is generated; but this is too weak for the ignition of illuminating gas, because the windings of the two electro-magnet bobbins employed cannot all act inductively upon one another, and further because the mass of iron in the electro-magnet is very small. The intercalation of a special induction roller is, in the present invention, superseded by the provision of a peculiar electro-magnet; an important diminution and simplification of the apparatus, as well as a concentric arrangement around the gas-supply tube being at the same time obtained."



The drawing shows a vertical section of the device, without the magnet armature and the plug of the gas-cock. Also a front view of the device.

A is a toothed wheel, serving in its rotation to close and open the cock; the teeth being arranged to correspond with ways in the plug, so as to alternately open and close the cock. The wheel is moved round by pawls in such a way that, upon each attraction of the armature P by the electro-magnet, the wheel is turned to the extent of one tooth, and therewith also the cock-plug to which the wheel is attached—thus closing or opening the cock. The current-breaking arrangement for producing the igniting spark consists of an angular stud or contact-piece K, guided in the periphery of the iron ring F, and normally held depressed by a spring. Upon the attraction of the armature by the electro-magnet, the stud is pressed upwards, rising away from the part C, which is in connection with the current, and thus producing the igniting spark in consequence of the interruption of the contact. The bi-polar electro-magnet is of a hollow form. A part E of soft iron of the gas-tube itself forms the one magnet core, and has at X its large pole. Upon this core is placed a wire bobbin D. The second electro-magnet core is formed by the iron ring F slid over the bobbin, and in connection with the inner core through the flat top G. The currents crossing in the wire bobbin act upon the iron ring, but in a manner opposite to that on the inner core; so that at the whole of the bottom edge B the opposite pole is originated from X, and therefore this electro-magnet acts upon a corresponding armature in the same way as a horseshoe magnet. The armature plate P is suspended, by means of a link, from the bottom edge of the iron ring F; and it is provided with an aperture or slot to take over the toothed wheel A, and thereby lessen the height of the apparatus.

Owing to the form of the electro-magnet, there is first obtained (says the patentee) the improvement that the whole of the windings of the electro-magnet are located upon one bobbin, all of which consequently act inductively upon one another, and that the iron mass of the electro-magnet is considerably increased—above all by the iron ring F. The inductive action of the alternating magnetism on the wire windings is also much increased. This magnet induction in all induction apparatus surpasses by far the induction through the cross currents in the bobbins; and thus the small apparatus generates for itself sufficiently strong induction currents for the ignition of the gas.

Charging Gas-Purifiers from the Overhead Traveller.—Gardner, H.; communicated from F. D. Marshall, of Copenhagen. No. 17,455; Sept. 13, 1894.

This invention has for its object the adapting of the overhead travelling crane or "goliath" employed in lifting purifier-covers to the carriage of skeps or buckets, for supplying the purifiers with lime or other purifying agent; also to fitting additional lines of rails in a gas-purifying shed, for moving such skeps or buckets when loaded, either for charging the purifiers or for the removal of the spent lime therefrom.

Fig. 1

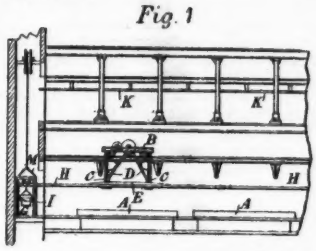


Fig 2

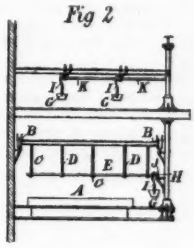


Fig 3.

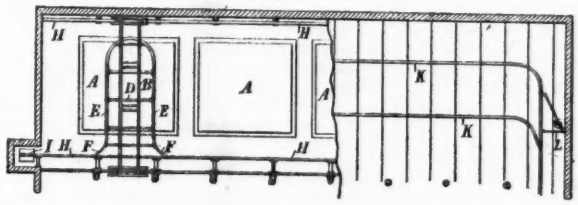


Fig. 1 is a part longitudinal section of a purifier-shed of a gas-works; fig. 2, an open end elevation; and fig. 3, a plan.

A are the purifiers; and B, the overhead traveller or goliath. C are bars hanging therefrom with stays or ties D. E is a rail, curved or half rounded at one end, and suspended from the bars C. F are switch points, for leading the skeps G from the main rail H to any position over the purifiers above which the traveller might be shifted. The rail is spanned clear of the traveller chains, so as not to interfere with any mechanism by which the purifier-covers are lifted or replaced. Each skep or bucket is suspended to swivel and turn for tipping purposes within a fork frame I, the upper end of which is provided with flanged wheels J, to run freely upon the rail H on which it can be moved.

In the drawings, a couple of rails K are shown in the upper floor of the shed, along either of which the skep can be pushed after action of the switch point L; so that, when the cage M is raised to the proper level, and the skep G run on or into it, the cage can be lowered for the skep to be transferred to the rail H of the lower chamber of the shed, for being shifted to the curved rail E suspended from the overhead traveller, for the contents of the skep to be emptied into the open purifier, the lid of which had been previously removed.

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21,185.—Powell, C. T., "Oil, gas, electric, and other light pendants." Nov. 5.

21,216.—Maule, C., "Converting any kind of a gas-burner, with or without removing glass globe, into a gas and air burner for heating or cooking purposes." Nov. 5.

21,222.—Willson, T. L., "Manufacture, distribution, and use of gas for illumination, heating, and other purposes." Nov. 5.

21,266.—Fiddes, A. and F. A., "Obtaining motive power for internal combustion motive engine." Nov. 6.

21,293.—M'Cormick, W. A., "Taps and valves for the supply or escape of fluids, gases, &c." Nov. 6.

21,348.—Newton, H. E., "Atmospheric gas-burners." A communication from R. N. Oakman, jun. Nov. 6.

21,396.—Bellamy, A. R., and Onions, R., "Gas and similar motor engines." Nov. 7.

21,574.—Voisey, C. B., Richmond, E. W. T., and Richmond and Co., Ltd., "Gas-burners." Nov. 9.

21,581.—Cunningham, E. A., "Self-starting gear for gas and oil engines." Nov. 9.

21,628.—Haeussler, J., "Regenerative gas-burner." Nov. 9.

21,655.—Duff, E. J., "Gas-producers." Nov. 10.

21,660.—Zimer, F. W., "Atmospheric gas-heaters." Nov. 10.

21,679.—Grubb, J., and Robinson, W., "Pendant fittings for carrying globes or shades for gas, oil, and the like." Nov. 10.

21,697.—Hadfield, T., "Gas-stoves." Nov. 10.

21,698.—Taylor, G. H., "Gas-fired steam-boilers." Nov. 10.

21,712.—Brough, C. S. and W. B., "Liquid-meters." Nov. 10.

Gas-Works Extensions at Ilkeston.—Owing to the rapid growth of Ilkeston of late years, and also to the recent decision of the Town Council to supply the hamlet of Hallam Fields with gas, the existing plant has become inadequate for the supply of the district; and it has been resolved to apply to the Local Government Board for sanction to borrow £2000, with which to enlarge the plant, and to defray the cost of the new mains required.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

Combinations of Traders in Gas-Works Materials.

SIR,—In his powerful indictment, in the last issue of the JOURNAL, of trade combinations, Mr. George Livesey did not mention the newly-formed union of retort and fire-brick makers, by means of which prices have in a recent instance been advanced about 60 per cent. as compared with those of last year. It is possible that a wholesome fear of foreign competition may temper the action of this union towards their London customers; but it is to be hoped that the latter, and all others similarly situated, will, in the general interest, give the preference to foreign goods at equal prices, so long as this combination lasts. Belgian fire-clay material of good quality has lately been supplied in North Wales at considerably less than Stourbridge prices; so we are not yet entirely at the mercy of the home manufacturer.

May not this subject of trade combinations be regarded as a very fitting one for the consideration of the various Gas Associations, or of such of them as do not admit traders into their ranks, with a view to concerting measures of defence? I am far from being an advocate of excessive competition, the injury from which is none the less serious because not always immediately apparent; nor can anyone desire to withhold from the manufacturer a fair and reasonable profit. But it is quite another thing to acquiesce in a system of spoliation.

CHARLES HUNT.

Birmingham, Nov. 17, 1894.

Compressed Gas.

SIR,—I notice the letter of "Inquirer" in the last number of the JOURNAL; and as I have had considerable experience in the use of both compressed oil and coal gas, I should like to point out to "Inquirer" that the records of that experience may be found in the files of the JOURNAL, commencing with a paper read at the meeting of The Gas Institute at Sheffield in 1883 on the "Lighting of Railway Carriages," and followed by other communications, &c.* I will therefore only now briefly state that both oil and coal gas can be compressed with equal facility; but both suffer, in compression, loss in volume and in illuminating value, according to the amount of compression and the original quality of the gas. If only four or five atmospheres compression is required, the ultimate loss will not be serious or prohibitory. There are two important factors which will affect this—the efficiency of the compressor employed, and the size of the recipient into which the gas is compressed direct.

With regard to the hypothetical case advanced by your correspondent, I think he will find it would be more economical to telescope his gasholder to provide for the surplus gas he has at times, and alter his governor (which would not be a serious matter) to meet the increased pressure given, rather than put down special compressing plant, with storeage recipients, &c. The cost of a steel egg-ended recipient to hold 200 cubic feet (normal) and the necessary compressing apparatus working up to ten atmospheres, which would provide storeage for 2000 cubic feet of gas, would be about £500, and every further 2000 cubic feet about £250. Then, of course, the loss in compression has to be added. There are, however, many special cases where compressed coal gas can be, and has been, used with great advantage; but it cannot now be compared with the general superiority of oil gas, where that is available for compression. The latter is really a "portable gas" in every sense of the word.

CHAS. E. BOTLEY.

Hastings, Nov. 15, 1894.

Unaccounted-for Gas.

SIR,—We have to thank Mr. Lewis T. Wright for giving his attention to the subject of unaccounted-for gas†—a subject which certainly requires more study than it has yet received. It would be a decided advantage to know what amount of gas is leakage, and what proportion can be assigned to incorrect measurement—that is to say, the difference between the gas measured at the station meter and at the consumers' meters.

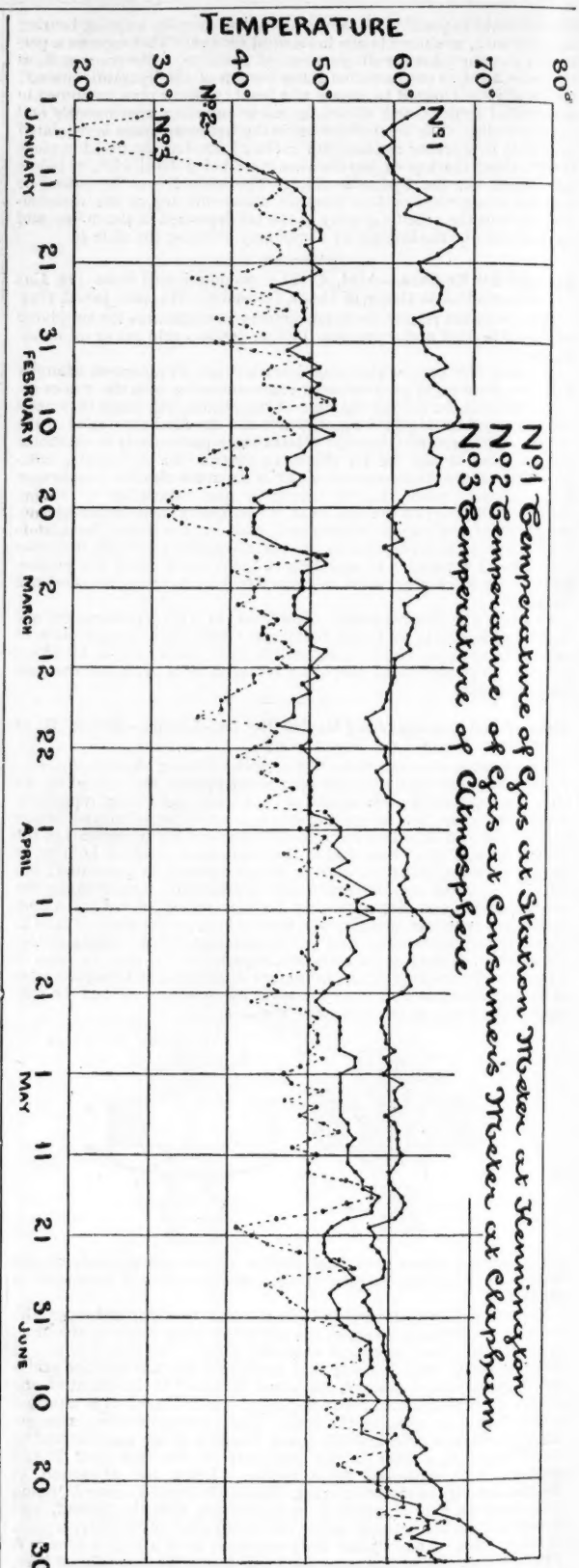
One of the conclusions arrived at in the article, which may be quite correct, is that the bulk of the gas unaccounted for is leakage. There is nothing, however, brought forward in proof of this assumption.

The correction of a volume of gas to a recognized standard of temperature and pressure is necessary for comparison for different times of the year, as well as for comparing the results of working at different places; but it is of no value for the purpose of arriving at the true volume of gas sold to the consumers.

Now that air or oxygen is very generally used to obtain better work out of the purifying material, it is very probable, should the station meter be placed no great distance from the purifiers, that the gas may be registered at a temperature considerably above the air temperature; and should it be sold at anything below this temperature, there will be gas unaccounted for.

This question may be simplified by leaving out the consideration of barometric pressure; for, unless the district varies in level to an appreciable extent, it will not affect the case, and even if it does, it is a fixed and unvariable quantity, to be added or deducted at all times.

Finding there were at times considerable variations in the unaccounted-for gas, I had thermometers placed at the outlet of several consumers' meters; and I have compared these with the air temperatures, and also with the temperature of gas as measured by the station meters. From these records, several charts have been prepared—one of which I send you as giving a fair representation of the whole. It will be noticed: First, that the gas is measured at a temperature considerably above the air; and this I may say continues throughout the year. Secondly, that gas in passing through the meter approximates to the air temperature; the extreme variations being reduced, depending upon the position of the meter. If exposed to external air, the average temperature will correspond very closely to the air; if in a warm part of the house, the variations will be much less sudden, and the gas will be warmer. Thirdly, it will be noticed—but to prove this all the charts should be examined—that the gas temperature in the consumers' meters will average something higher than the air.



The temperature of the gas in the mains need not be considered; for in passing through the meter (generally a tin-case one) as it does at a comparatively slow rate, recent experience in regenerator firing has taught us that gas, like air, will soon assume the air temperature.

The readings have not yet been taken over a sufficiently long period to form a definite rule. They have, however, made this clear—that if any correction is needed it should be to a temperature somewhat above the air temperature, and that the station meter registration in all the three cases investigated has been found to be considerably above the temperature at which the gas is sold.

* See JOURNAL, Vol. XLI., p. 1189; Vol. XLIII., p. 226; Vol. XLV., p. 291; Vol. XLVI., p. 507, also p. 421.

† See *ante*, p. 821.

The subject undoubtedly requires further attention; and if information could be given from other districts, it would help possibly to some settlement of the question.

The chart shows the average air temperature, the temperature of gas at the station meter at Kennington, and the temperature of the gas as registered in a consumer's meter in the neighbourhood of Clapham Common—the temperature being taken at different times of the day when the gas is being used.

South Metropolitan Gas Company, Nov. 9, 1894. FRANK LIVESEY.

Gas as a Motive Power in the East.

SIR,—In your issue of Sept. 11, you have a paragraph relating to an account of an experiment that is being made to introduce gas-engines as a motive power into Ceylon. To show you it is neither new nor novel in the East, I should like to mention that in Singapore, which is 1800 miles beyond Colombo, and a much younger city, gas-engines have been in use for years. Notably the premises of the Telegraph Company (for generating electricity for lighting), several printing works, aërated water manufactories, sail makers (for driving sewing-machines), and others. I have never gone into the cost as compared with coolie labour, for the simple reason that I know—apart from the advantage gained in efficiency—the great incentive to adopting gas-engines here has been economy. This gradually extending value is as much the order of the day in the far East as in the West. From inquiries made of the heads of departments where these engines are in use, I have invariably found they give every satisfaction. I am now contending with a strong disposition on the part of new users of this power to favour oil-engines, on account of cheapness. By a careful and, I believe, impartial calculation it appears to me that oil at 5d. per gallon, as compared with gas at 4s. 2d. per 1000 cubic feet, shows a saving of about 20 per cent. But against this must be reckoned the storeage of oil—an element of danger, which to my mind more than outweighs the saving. In one or two instances recently, my views have prevailed, and preference has been given to the gas-engine. Where *primâ facie* cases of saving are shown, I find it very difficult to convince the public that the many contingencies of risk from fire and explosion, which accompany the storeage and use of oil, are minimized where gas is made the medium for supplying their wants.

Singapore, Oct. 17, 1894. H. W. SMITH.

Gas-Fires in Hotel Bedrooms.

SIR,—With reference to some recent notes on this subject, we may fairly claim that we have one of the best arrangements of the kind suggested as being desirable. But before offering it, we submitted it to several experienced gas engineers, who all unhesitatingly condemned the introduction of anything of the kind, for the following reasons: (1) That a fixed time of (say) one hour, was objectionable. It would frequently happen that the fire was wanted for a longer period; and the necessity of relighting at an extra cost would tend to cause annoyance. (2) That the apparatus, if fixed and (as it probably would be) condemned after a short trial, in favour of a coin-in-the-slot meter, would be totally useless for any other purpose. (3) That the coin-in-the-slot meter was in every respect beyond any comparison superior to any time arrangement. If set to give (say) 100 cubic feet for 1s., the fire could then be turned on, and used at full power for three or four hours; and another shilling would extend this time—giving the user complete command over the fire for any length of time, and allowing it to be used either full on for three or four hours or turned low all night, at the usual cost of a coal-fire in any hotel bedroom. The coin-in-the-slot meter with a gas-fire, in fact, gives all the advantages of a coal fire, without its disadvantages. (4) In case of the removal of the apparatus, no loss is incurred, as both the meter and fire are useful for ordinary customers.

The matter was most carefully considered; and although we felt that to discard the arrangement would, no doubt, deprive us of a pretty and novel advertisement, we preferred to sacrifice this rather than offer an apparatus which we felt would be inferior in practice to other arrangements which already existed, and admitted of easy application without risk of loss.

Warrington, Nov. 16, 1894. FLETCHER, RUSSELL, & Co., LIMITED.

Dunedin (N.Z.) Suburban Gas Company, Limited.—In the report of the Directors of this Company for the twelve months ending June 30 last, which was presented at the annual general meeting on the 8th inst., it is stated that the improvement shown in the previous year's accounts had been maintained, and that the profit earned had been £381. Adding the balance brought forward (£120), there was an available sum of £501, out of which the Directors proposed to place £100 to the credit of the reserve fund, and to pay a dividend of 1 per cent. The payments absorbed about £370, and left £31 to be carried forward. In the hope of still further extending the Company's business, the Board have appointed two influential gentlemen in Dunedin as a Local Committee to act in conjunction with the Manager.

The Large Leakage of Water at Nelson.—There was a long and heated discussion respecting the water supply at the meeting of the Nelson Town Council on the 9th inst. It may be remembered that, at the previous meeting, it was determined not to proceed with the proposed extension of the water-works, owing to a discovery having been made that there was a considerable leakage of water in the town, which, if its source was discovered, would render additional works unnecessary at present. The Chairman of the Water Committee (Mr. Astley) now reported that the leakage was between 400,000 and 500,000 gallons per day, and that this had been reduced by about 100,000 gallons. Interrogated on the subject, Mr. Astley admitted that people had been using meters which did not register, and that the tenants of some shops and cottages had been consuming water ever since the property was erected without payment. He accounted for the irregularities in the department by the "penny-wise and pound-foolish" policy of the Water Manager in having the department understaffed.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Friday, Nov. 9.

(*Before Mr. Justice* CHITTY.)

Cleveland Water-Works Company v. Redcar Local Board.

This was a motion by the plaintiffs for an injunction to restrain the defendants from constructing a reservoir at Upleatham until they had first given notice to them, in accordance with section 52 of the Public Health Act, 1875.

Mr. WHITEBORNE, Q.C., and Mr. MICKLEM appeared for the plaintiffs; Mr. BYRNE, Q.C., M.P., and Mr. LAWRENCE represented the defendants.

The case was argued at great length; but the facts, as well as the question of law, are sufficiently stated in the judgment.

Justice CHITTY: The question in this case turns upon the construction of sections 51 and 52 of the Public Health Act, 1875; and the facts are shortly these: The predecessors of the defendants in 1856 constructed water-works for the supply of the district of Redcar. They obtained a lease of land for a reservoir, and a supply of water from Lord Zetland; and they borrowed money, under the powers of the statute, for the purpose of making the works. They carried them out, not under the Act of 1875, but under the Public Health Act of 1848, which contained in one section (75) substantially the same provisions as those in sections 51 and 52 of the later Act. The defendants therefore acted under statutory authority; and they have from time to time added to and enlarged those works. They did so in 1883, when they constructed a reservoir capable of containing 450,000 gallons of water; and they laid down more pipes for the supply of water to the district. They made additions again in 1886; and they obtained, in the meantime, a renewal of the lease from Lord Zetland. Hitherto they have procured their water from a particular source. The plaintiff Company was constituted by Act of Parliament in 1869 for the purpose of supplying water to a large district, which includes Redcar; but hitherto they have not furnished any water to Redcar. The population of the town in 1886 was from 1200 to 1400; but it has now increased to 2800. The rateable value of the property has gone up during the same period from £3500 to £13,000. The defendants now propose to construct some works which are plainly water-works—*i.e.*, an additional reservoir, to be connected with the existing one, and to contain 6 million gallons; and they have obtained, by agreement with Lord Zetland, a further source of supply. They say they are doing this partly by reason of the drought that occurred last year, and partly to meet the increasing requirements of the place. The plaintiffs say that the defendants are not justified in their proposal to construct these new works until they have given the notice required by section 52 of the Public Health Act, and otherwise complied with its terms. That section must be read in connection with the 51st; and I think I am justified in saying that the object of the 52nd section was at least to afford protection to a water company such as the plaintiffs are. It may be also, as was said by Vice-Chancellor Hall, in one of the cases referred to, that it was for the benefit of the ratepayers; but in the same case he held—and I have no hesitation in following his authority—that a water company such as the plaintiffs are entitled to sue on the 52nd section. In the opening of the case, the popular expression "monopoly" was used with reference to the plaintiff Company; and it was said that they had the statutory monopoly of supplying water to this district. Now, the term "monopoly" may pass in ordinary language; but the true view of the matter is this—that Parliament has constituted the Company for the purpose of supplying with water the large district which is covered by their Act of Parliament. There is no monopoly, in terms, conferred upon the Company; there is no section denying the right of any other person or company who may be able to do so to supply water within the same district. But the term "practical monopoly" very fairly represents the position of the plaintiffs, because no person or company can practically carry on the business on a large scale of water supply to a district without the authority of Parliament. One point only it is sufficient to mention—the power to break up streets for the purpose of laying down pipes. In another sense, too, a water company may be said practically to have a monopoly, because, according to the usual practice of Parliament, where there is an existing Company performing their statutory obligations, and competent to give the requisite supply, it is not the practice to incorporate another to supply water within the same district. It is plain in this case that the plaintiffs have no monopoly for the supply of water in Redcar; because, as I have stated, the Local Board have the right. The plaintiffs are asking for an injunction to restrain the defendants from proceeding with their proposed works; but if these are executed, the plaintiffs will still be at liberty to supply water in Redcar to any persons who are willing to take it from them. Until the present time, the plaintiffs have not been in a position to provide the town with water; but they have recently constructed works for serving a neighbouring district, and their pipes are now available for Redcar There is no question that the plaintiffs are ready and willing to supply water. Now to deal with the question of construction. The two sections of this 1875 Act ought to be read together. The 51st section authorizes a local authority to provide their district with a supply of water proper and sufficient for public and private purposes; and there are similar words in the Act of 1848. Consequently, the defendants are in a position to say, as they do, that they have parliamentary authority for the supply of water. The rest of the section is not very material. It gives them power to make and maintain water-works, &c.; and to take on lease, or hire, water-works, and to contract for the supply of water. Then comes the 52nd section, on the introductory words of which the argument mainly turns. "Before commencing to construct water-works within the limits of supply of any company empowered by Act of Parliament, &c., the local authority shall give written notice to the water company, stating the purposes, and, as far as practicable, the extent, to which the supply of water is required by the local authority." Then comes this: "It shall not be lawful for the local authority to construct any water-works within such

limits, if and so long as any such company are able and willing to supply water proper and sufficient for all reasonable purposes for which it is required by the local authority." I have listened to much argument on the meaning of the term "water-works" in the 52nd section; but it was admitted by the plaintiffs' Counsel that the whole of the words in the 4th section which it is enacted shall be included in the term are not introduced into the 52nd section. It was seen that the supposed definition clause contains the usual limitation that the words are to have the meaning affixed, "if not inconsistent with the context." Many cases were put by way of illustration; but, in my opinion, this at least must be accepted as the true meaning of the Legislature. If there were existing water-works owned by the local authority, the mere repair of those works would not be within the 52nd section. Starting from this point, I heard many suggestions, and it was admitted that any slight enlargement of existing works would not be within the section. It comes, therefore, to this—that the prohibition in the 52nd section is not absolute, but one of degree. Then comes the question: At what particular point will the Court which has to construe the Act make a stand? It was pointed out for the plaintiffs that the new works are greatly in excess of those existing; and it was said that there was therefore a "construction of water-works" within the meaning of the section. In my opinion, the section was not intended to apply to the case where a local authority had, prior to the passing of a Special Act incorporating a company such as the plaintiffs, already substantial works in existence. In this case, the defendants had water-works in operation at the time the plaintiff Company was incorporated; and they had hitherto been, in fact, sufficient for the requirements of the district. There may occur, in the course of time, many things which justify alterations and additions to the existing works. An illustration was given of improved filtration, for which a larger area may be required. It seems to me that it would be unreasonable to hold that Parliament meant to say that a local board who had already constructed water-works which were in operation could not improve those works. I think, in effect, if it be necessary for the purpose of my judgment—which it probably is—I ought to hold that the words "before commencing to construct water-works" refer to new works, in the fair and reasonable sense of the term; and that they do not apply to the improvements of, or additions to, existing water-works. I do not see how I can safely stop at any particular point, as to the degree of enlargement or improvement. It seems to me, therefore, that the true reading of these sections is such that the defendants are not under the obligation contended for by the plaintiffs, of giving them notice before proceeding to execute the works contemplated.

Mr. BYRNE said the parties had agreed to treat the motion as the trial of the action.

His LORDSHIP therefore dismissed the action, with costs.

Friday, Nov. 16.

(*Before Mr. Justice* NORTH.)

Tucker v. Eastman—The Mauritius Gas-Works.

This was a motion for an injunction by which the plaintiff, who carries on business under the style of Messrs. Nicholls and Co., sought to restrain the defendants, Messrs. Eastman Bros., from disposing of the Mauritius Gas-Works to anyone other than the plaintiff, who claimed to have a binding contract for the purchase thereof.

Mr. EVERITT, Q.C., appeared for the plaintiff; Mr. EUSTACE SMITH and Mr. S. EADY represented the defendants.

It appeared that one of the Messrs. Eastman being Liquidator of the Mauritius Gas Company, the defendants, on his behalf, in July last issued a circular inviting tenders for the purchase of the property. These were to be opened on Oct. 10. If the purchaser was then declared, he was immediately afterwards to make a deposit of 20 per cent., in part payment of the purchase-money; and the purchase was to be completed on Dec. 10. The plaintiff's was the only tender—the amount being £3000; and a verbal acceptance was given at the time, and a letter written the same day saying: "We beg to inform you that your tender of £3000 has been accepted, and that the deposit of 20 per cent. is payable to us forthwith. In accordance with your representative's request, we give you the whole of to-morrow to make this payment; and the formal acceptance, with the receipt for the deposit, lies here signed, ready to be taken up. We understand you are to attend at our office at 2.15 to-morrow for this purpose, which appointment we beg to confirm." This letter the plaintiff stamped; and he now contended that it was a binding acceptance of his tender, and made a contract which the defendants were not at liberty to rescind. The payment of the deposit was not made at the time stated; and further time was given—first, until the 15th, and then until the 19th. Ultimately, on the 22nd of October, the defendants wrote saying that they had disposed of the property to another party who had paid a deposit.

Mr. EVERITT argued at great length that the contract could not be cancelled in this way; and that, at any rate, he was entitled to an interim injunction to keep things *in medio* until the case could be tried—there being some conflict of evidence as to what had passed with regard to a cheque which was dishonoured owing, as plaintiff alleged, to its having been presented a day earlier than had been arranged.

Justice NORTH, without calling on defendants' Counsel, dismissed the motion; holding that the vendors were entitled to say that the contract, if there was any, was at an end when the deposit, which had to be made forthwith, was not paid within the time allowed, which time was not only reasonable, but more than reasonable under the circumstances.

The Spalding Improvement Commissioners' Gas-Works.—The Spalding Improvement Commissioners have decided to reduce the price of gas by 5d. per 1000 cubic feet. This will make the charge 3s. 4d., or 2s. 10d. when promptly paid; an extra discount of 6d. being allowed in this case. The annual report shows that the works are now free from debt; that the profit for the year amounts to £2125; and that the consumption of gas is on the increase.

MISCELLANEOUS NEWS.

PROJECTED LEGISLATION AFFECTING THE GAS AND WATER SUPPLIES OF DUBLIN.

A Special Meeting of the Municipal Council of Dublin was held on Monday last week—the Right Hon. the LORD MAYOR presiding—to consider and, if approved, to adopt, a resolution in reference to promoting an Improvement Bill in the next session of Parliament, for the following (among other) purposes: "To alter and modify the existing arrangements for the supply of water by the Corporation to certain of the adjoining townships, and to exempt all moneys expended or to be expended for water-works purposes from the operation of section 238, sub-section 2, of the Public Health Act, 1878;" and "to alter and modify the existing arrangements for the supply, price, and testing of gas in the city."

The LORD MAYOR, in moving the adoption of the resolution, said the first question for consideration had reference to the relationship between the city and the townships in regard to the water supply. A report on the subject by the Water Committee had been adopted by the Council; and he would not refer to the matter now only that, since the report was adopted, certain things had happened. They all knew that Kingstown and Dalkey were trying to free themselves from the statutory obligation to take water from the Corporation. Within the last three or four weeks, a portion of the members of the Kingstown Township Board sought to obtain power to proceed with a Bill, for the purpose of getting an independent supply. He was glad to see the proposal was defeated. In this matter, the Corporation did not desire to seek any undue advantage over the Commissioners; and they hoped to be able to come to an arrangement with them which would not be to their disadvantage. It was ridiculous that they should so long tolerate a system pursued in regard to the supply to the townships—that was, that they should supply to the townships a quantity of water which was never paid for. Under the present Act of Parliament, they were obliged to supply a township with 750,000 gallons of water; but the township stated that they only wanted 500,000 gallons, and they would not pay for more. They sought to make the townships pay for the excess water. But they were defeated at law on a technical point; and they wanted to supply the water by meter to the townships at a fair price. They also intended to increase the storeage at Roundwood. If they did not get the increased accommodation, the townships would be able to say, in opposing the Corporation: "The supply failed once, and it may fail again; and we are therefore entitled to get an independent supply." A further proposition was that the value of the water-works producing a revenue of £20,000 a year should not be excluded from the rateable value of the city by which the borrowing powers of the city were limited. As to the proposal "to alter and modify the existing arrangements for the supply, price, and testing of gas in the city," he said that, since he had been in the Council (ten years), an unseemly contest had gone on between the Gas Company and the Corporation. It was a contest that should not go on between two bodies who were supposed to be imbued with honest intentions, and neither of whom were supposed to seek to obtain an advantage over the other. He hoped that, during the passage of the Bill, they might arrive at some *modus vivendi* between themselves and the Gas Company, which would put an end to these disputes. In 1866 the official testing-station was in the basement of the City Hall; and the other at East Hanover Street. In 1871 the Gas Company procured an Act which approved of the testing-station subsequently erected at Burgh Quay. On the expiration of the agreement—viz., 1876—the other stations were abolished; and the Burgh Quay station became the only testing-place. This was a very inconvenient arrangement; and possibly much of the trouble that had arisen might be due to this. Because they knew that different mains led from the gas-works to different parts of the city; and all the gas did not pass by the main at Burgh Quay. In 1874 an Act was passed, which authorized the appointment of Professor Tichborne as Gas Examiner. In 1883 another Act was passed, by agreement between the Corporation and the Gas Company, authorizing the changing of the station from Burgh Quay. But nothing was done until 1890, when the matter was taken up; and in 1891 an award was made with which the members were all familiar, under which the new testing-station was erected in Tara Street. He did not make any suggestion on the subject; but it was quite competent for the Gas Company to send gas through different mains other than the main which passed to the testing-place at Tara Street. [Alderman GILL: That is suggesting robbery.] He (the Lord Mayor) did not suggest that the Company supplied one sort of gas through one main and a different kind through another. He was assuming that they were not guilty of robbery, as Alderman Gill suggested; but they ought to be glad to get rid of the suggestion that such a thing was possible. If it were necessary to have three or four testing-places, they ought to have them; and he pressed the Council to go for them.

Alderman GILL: As a matter of fact, you will allow me to state that all the gas supplied to the city leaves the gas-works through one main.

The LORD MAYOR said he did not want to debate the matter over the table; but it was contended that all the gas which went to the city was not tested at Townsend Street. With reference to the Tara Street testing-place, the Company claimed to be the persons—and they were so by Act of Parliament—who had erected the station and were given the control of it. They had the key, and allowed the Corporation to test the gas under certain conditions. In other places, the contrary was the practice; the stations being absolutely under the control of the local authority—provision being made for the gas company being present when the tests were made, if they wished. He proposed that Dublin should obtain power precisely similar to that given to the local authorities in the Commercial and other Gas Companies' Acts in England; so that they could control the testing.

Mr. CLANCY wished the Lord Mayor would announce that there was no intention, as had been rumoured, of purchasing the Company's undertaking.

The LORD MAYOR said he could not in the least foresee what the

Council of future years might do; but he did not think this was the time for local authorities to acquire gas-works. Ten or fifteen years ago, it might have been open to the Corporation to purchase; but the negotiations fell through, at the instance of the Chamber of Commerce. Returning to the subject of testing, he said he had a table showing the average results for the past twelve months of the tests made by their own Examiner (Mr. T. J. Cotton) and by Professor Tichborne. [The Lord Mayor proceeded to read the figures, from which it appeared that Mr. Cotton's results ranged from 13·3 to 14·6 candles, or an average for the year of 13·9 candles. On the other hand, the lowest of Professor Tichborne's returns was 15·91 candles, and the highest 17·31 candles; the average for the year being 16·54 candles.] Proceeding, his Lordship said Professor Tichborne tested the gas upon an instrument of a pattern 26 years old. In 1891 that class of photometer was removed by an order of the London Gas Referees out of all the testing-places in London, of which there were some 20; and the Evans improved photometer was substituted. Immediately after this change, the gas which had been tested in some of the London stations by the old Evans at 18 candles turned out by the Evans improved to be of only 16-candle power. He did not know whether this accounted for the difference in the testings in Dublin. Mr. Cotton used the photometer sanctioned by the Gas Referees; while Professor Tichborne employed the condemned one, which, though stamped provisionally by the Board of Trade, they had now refused to stamp as an instrument for use.

Alderman GILL said the burner used in Dublin in testing the gas [a flat-flame] was different from that employed at all other places in the United Kingdom.

The LORD MAYOR (continuing) said he thought the Corporation ought also to have a portable photometer that could be used in any part of the city. Coming to the question of the price of gas, he said that, by the Act of 1883, it was provided that the standard price should be 4s. 1d. per 1000 cubic feet in the city; for the townships of Pembroke and Kingstown, 4s. 4d.; and for the other townships, 5s. The sliding scale was also applied by that Act. The present price of gas was 3s. 7d.; so that the Company could increase the dividend by 1½ per cent., entitling them to 11½ per cent. The Company were not now paying that; but he was sure they would if they could. In 1890, the price of gas was down to 3s. 4d.; and the Company could then, if they wished, pay a dividend of 13¼ per cent. Having quoted the prices charged for, and the illuminating power of gas in the principal towns in England, the Lord Mayor specially referred to the present prices in London. Of course, he said, the position of the Dublin Gas Company should be fairly considered; and it should be remembered that the London districts were compact, while the Dublin gas-supply area was a very straggling one.

Alderman GILL pointed out that the mains of the London Companies carried twenty times as much gas as the mains in Dublin; and yet the same amount of capital was invested in them.

The LORD MAYOR said he did not desire to be unfair to the Gas Company; and he thought the facts required investigation. There were subsidiary questions also to be considered; and he did not know what reception they would meet with in Parliament. It was suggested that the Corporation should have power to appoint an auditor to examine the accounts of the Company, to see whether the sliding-scale was properly carried out.

The HIGH SHERIFF (Mr. F. M'Coy) seconded the motion, which was unanimously carried.

HUDDERSFIELD CORPORATION GAS AND WATER UNDERTAKINGS.

The Working during the Past Municipal Year.

Alderman J. J. Brook, who has been re-elected to the mayoral chair of Huddersfield, presented to his fellow-councillors, at their meeting on the 9th inst., a long statement dealing with the work of the various departments of the Corporation during the year; and from it we have extracted the following references to the gas and water supplies.

Alluding to the Gas Department, his Worship says that it continues in a prosperous and increasing condition. During the past year, 561,975,000 cubic feet of gas were produced, as compared with 544,913,000 cubic feet for the corresponding period—showing an increase of 17,062,000 cubic feet, or 3·13 per cent. The illuminating power of the gas has been further increased by one candle during the year; making a total increase of 2½ candles in the course of the past two years. This increase represents an additional value on the gas consumed equal to 3¾d. per 1000 cubic feet, or a total sum of £8020 on the annual output, calculated upon its cannel value. The purity of the gas has also been much improved since the completion of the new plant; and it is now equal to the stringent requirements of the Metropolitan Gas Referees and their sulphur clauses. The structural alterations and additions which were referred to twelve months ago have since been completed and put to work, and have made their influence felt for good, in not only improving the quality, but also in cheapening the cost of production. A portion of the new retort-house is now in course of erection, and will be equipped with carbonizing plant ready for the winter of 1895. Owing to the fact of this being erected in place of the old retort-house, some difficulty may be experienced in maintaining an efficient supply during the depth of the coming winter. In designing this building, provision has been made to permit of water-gas plant being partially adopted, to be used as an auxiliary to the other plant, to meet the constantly varying demands during dark and cold weather, without any structural alterations, should the experiments now being carried out in London, Liverpool, Belfast, &c., prove to be commercially profitable. The capital expenditure on the works on Sept. 30 last amounted to £323,996.

With regard to the Water Department, the Mayor states that the Blackmoorfoot and other storeage and service reservoirs have been maintained in good condition. The quantity of water in store in the Blackmoorfoot reservoir is 542 million gallons, as compared with 232 million gallons at this time last year. The total length of the mains is 234½ miles. The quantity of water supplied through meter for the past year was: Inside the borough, 364,299,000 gallons; outside, 54,162,000 gallons—total, 418,461,000 gallons, as compared with 485,175,000 gallons in the previous year; being a decrease for trade purposes of 66,714,000 gallons. The estimated population supplied is: Inside the borough, 108,340; outside, 37,365—total, 145,705, as compared with 143,925. The total number of meters fixed is 573, as compared with 562. The net income for water for the year ending March 31, 1894, was £48,857; and the profit on the department was £4346. Regarding the construction of the Butterley reservoir, the excavation of the puddle trench is now almost completed, and is carried down to a bed of hard shale, 40 feet in thickness, which forms the foundation, at a depth of 80 feet below the crossing of the Wessenden Brook. The depth of the excavation at the extreme ends of the trench is more than 200 feet. The tunnel is completed, with the exception of the portion crossing the valve-shaft and trench. The tunnel fronts, gauge-basin, and channel connecting the tunnel with the bye-wash are all finished. The excavation, concrete, and masonry for the bye-wash are finished for a length of 280 feet. The formation of the embankment is carried forward as far as it can be done until the river is turned through the channel. The capital expenditure on the water undertaking on Sept. 30 last amounted to £1,043,359.

SOUTHAMPTON GAS COMPANY.

The Half-Yearly General Meeting of the above Company was held on the 7th inst.—Mr. R. C. Hankinson, J.P., in the chair. The Directors in their report for the six months ending June 30 stated that the amount available for division was £11,153, out of which they recommended the payment of the maximum dividends; leaving £3051 to be carried forward. During the half year there had been an increase of 9,104,000 cubic feet of gas sold, as compared with the corresponding six months of 1893. The Directors expressed their satisfaction with the condition of the works, which they considered were capable of meeting all the demands that could be made upon them in the coming winter. The Chairman, in moving the adoption of the report, said he thought he might fairly congratulate the shareholders on the continued prosperity of the Company. The increased employment of gas had been steady, and it was well distributed over the whole district. The day consumption, to which the Directors attached considerable importance, had augmented; and there were now 767 gas-stoves in use in the town, and 70 gas-engines at work, all consuming gas in the daytime. Beyond these, there were many more gas-fires than formerly. It had been found necessary, owing to their increased business, and the frequent uncertainties of the labour market, to increase the storeage of coal; and they had arranged to accommodate 1250 tons more on their own wharf at Chapel. The benefit society established by the Company's workmen was in a flourishing condition. The Directors were specially concerned with this society, as fostering a good feeling between employers and employed; and they were therefore prepared to help it, if necessary. But hitherto it had been self-supporting—indeed, lately there was a surplus of money which the men themselves requested should be invested in shares of the Company. The average price of £38 2s. 4d. per £25 share obtained at the last auction sale was the highest ever reached; but he was informed that one of the shares had since been sold for £40, which was the largest amount ever paid for one of these shares. The old works were in a satisfactory and efficient condition; and the new ones were progressing rapidly. Dr. Sampson, in seconding the motion, remarked that the increased consumption of gas was eloquent evidence that the Company need no longer fear the electric light. Of course, in the case of a large installation of electricity like that at the Docks, there would be less gas consumed in that particular locality; but, taking the Company's district as a whole, there was no loss at all. He was told that captains coming up Southampton Water at night had complained of the dazzling effect of the electric light at the Docks. He referred to the abolition of the light in Drury Lane Theatre and other places, and the growing public appreciation of the Welsbach incandescent gas-light; remarking that their Engineer (Mr. S. W. Durkin) had been at some pains to show the public of Southampton what could be done with that light by fixing one in the upper part of the town. While the previous light was of 90-candle power, the present one was of 360-candle power, with no greater consumption of gas; and the cost was about one-eighth less than that of the electric light. The report was adopted; and the maximum dividends were declared. Votes of thanks were then accorded to the Chairman and Directors, the Secretary (Mr. C. Crowther Smith), the Engineer, and staff generally, and the proceedings closed.

Oriental Gas Company, Limited.—In the report to be presented at the meeting of this Company next Wednesday, the Directors state that in the year ending June 30 last the business made progress; and the result of the operations would have been generally satisfactory but for the heavy loss sustained on exchange. The depreciation of the rupee diminished the profits by £26,537, as against a corresponding amount of £23,071 in the preceding year. To meet this depreciation, the Directors are making all possible efforts to develop their business; and the interests of the Company continue to receive on the spot the careful attention of the Manager (Mr. D. C. Niven) and the staff. Debentures to the value of £5900 were paid off during the year. New mains to the extent of 4·6 miles were laid; and 158 additional public lamps were erected. The Directors express regret at the loss they have sustained in the death of Mr. H. L. Hammack; and they report that they have provisionally appointed Mr. R. Miller to fill the vacancy on the Board. The accounts accompanying the report show a balance of £29,373, after payment of the interim dividend of 3½ per cent. in June last, and carrying £1250 to the reserve account; and they recommend the payment of a dividend of 4½ per cent., free of income-tax. This will make 8 per cent. for the year, and leave a balance of £15,873 to be carried forward.

THE GAS EXHIBITION AT CHESTER.

Mr. T. E. Pye, of Shrewsbury, on Coal Gas and Its Uses.

As briefly mentioned in last week's issue, a very successful exhibition of gas appliances was held in Chester during the four days ending on the 9th inst. The proceedings were opened on Tuesday afternoon by the Mayor (Alderman L. Gilbert); and in the evening by the Sheriff (Dr. Hamilton). In introducing the exhibition to the notice of the citizens, both gentlemen made reference to the strides that have been made in the improvements in the manufacture and supply of coal gas, and also in appliances designed for its combustion, and expressed the opinion that gas would go on side by side with the electric light, to a supply of which the Chester Corporation are pledged. The opening ceremonies were attended by a large number of the influential residents; and great interest was manifested in the various exhibits in the hall. The principal exhibitors were Messrs. John Wright and Co., with their well-known "Eureka" cookers, "Queen" and other gas-fires, and the usual assortment of stoves and burners; Messrs. Fletcher, Russell, and Co., with an excellent variety of cooking-ranges, new patented incandescent gas-fires, with silent non-firing back burners, also a considerable number of patented burners for trade and technical purposes; and Messrs. Richmond and Co., with their "Model" series of cookers, and gas-fires with the new patented burner. Other exhibitors were: T. G. Marsh and Co., who had a number of their prepayment meters on show, also registering pressure-gauges, &c.; Ralph Heaton and Co., with cases of gas-burners of various descriptions; Sawyer and Purves, of Manchester, with an assortment of brass fittings and models, with glass front, of prepayment and other meters; the Gas-Meter Company with similar exhibits; and the Gas Apparatus Company, showing Hawkins and Barton's patent self-regulating gas-burners. The Albo-Carbon Light Company were represented by a stand, comprising a selection of pendants and brackets, displaying a variety of albo-carbon burners. The Incandescent Gas-Light Company, Best and Lloyd, of Birmingham, and Winfields, also of that city, were represented at the Chester Gas Company's stand, as were also Alder and Mackay's patent meters and attachment. Bruce Peebles and Co., were in evidence with an assortment of governor burners and service governors. A number of Siemens high-power lamps for halls, drawing-rooms, lobbies, &c., were tastefully distributed about the hall. W. and B. Cowan and Thomas Glover and Co. had exhibitions of their meters, and finished brass appliances, including the model of a station governor by the first-named firm. Joseph Turner and Co., of Queensferry, showed an interesting case of tar products. During the week, Mrs. Page gave a series of lectures—in the afternoon on high-class cookery, and in the evening on every-day cookery. The lectures were very largely attended. The officers of the Company must be heartily congratulated upon the success of their efforts, and the completeness of the show brought together, for the instruction of their consumers.

A feature of the exhibition was the new prepayment meter, which the Chester Gas Company are now introducing; and in this connection they engaged Mr. T. Ebenezer Pye, of Shrewsbury, to give a popular lecture on the domestic uses of gas. The lecturer was introduced to the audience, on Wednesday evening, by Dr. Stolterforth (in the absence of the Chairman of the Gas Company, who was unable to preside through illness). After replying to the Chairman's remarks, Mr. Pye commenced his lecture by a description of the characteristic formations of the coal measures, and explained the accepted theory of the origin and development of coal. The different classes of coal were referred to, and their respective utility to the gas producer. The lecturer afterwards touched upon the properties and capabilities of various coals, and remarked that the price of coal in a certain district did not depend so much upon the close proximity of coal fields as upon the nature and capabilities of the particular coals which might be best suited to the working plant of the gas-works there located, and which might really necessitate their being brought from a much greater distance, in order to obtain results the most satisfactory alike to the producer and consumer. The whole procedure of gas manufacture and purification was then explained; the lecturer's remarks being illustrated by a complete working model of a gas-works, and also by a number of lucid lecture diagrams. This part of the lecture was listened to with the closest attention; the various points illustrated being heartily applauded by the audience. The model retorts were "charged" with a scoop; and the production of the gas was indicated by the rising of the gasholder. The gas thus made was tested for impurities; and, being found perfectly clean, was eventually burned, at the close of the lecture, in a Welsbach burner. The great advantages of gas for domestic purposes were then carefully gone into, and an explanation given of the principles underlying economical and satisfactory gas consumption; and by means of one or two humorous incidents, the lecturer showed that the so-called black "sulphur" deposits on ceilings are often mere indications of a wasteful method of burning the gas, and actually do represent the loss of its most highly luminous portions. The lesson to be learned was that globes with contracted bottoms should be discarded for the more modern wide-bottomed globes (which not only assist in developing more light *at the flame*, but they also give to the consumer a far higher percentage of the light thus developed), and also that service or—better still—burner governors should be generally adopted. Comparing the relative safeties of gas and other illuminants, the lecturer showed that, from the Metropolitan Fire Brigade returns of the year 1893, the number of fires due to artificial illumination may be estimated as follows: Due to oil and candles, 1010 (with very many fatal results); due to gas, 390 (with *no* fatalities). The lecturer stated that these returns embrace districts where gas is burned in enormous quantities, under dangers that can never exist in ordinary provincial towns; and that the latter would therefore give a very much lower percentage of fires due to gas than can be the case in London. The popular fallacy of food being tainted by cooking with gas was explained away—first, by the illustration of the coke-grilled mutton chop, and, secondly, by showing that food when cooking is exuding the whole time and incapable of absorbing fumes (injurious or otherwise). The audience were urged to keep all cooking utensils, the cookers, and all the various appendages, scrupulously clean, also the burners, which should always give a clear blue flame. By so doing, they would obviate any objectional smell. Coal gas as a cooking agent is far cheaper, cleaner, and more healthy, than coal; and, for heating purposes, it is—fuel for fuel—more expensive than coal, except for occasional use only, when it may be much cheaper. But the saving in carrying coals and ashes, in cleaning, and in wear and tear will often render it actually cheaper; while for bed-room use in case of illness, it is invaluable and highly recommended by the medical faculty. In conclusion, the lecturer showed how, by the aid of the new prepayment meter, the respectable artisan and working man could now have a gas supply laid on, and have all the advantages of gas cooking, and four and-a-half hours' lighting for 2½d. per day. The lecture was brought to a close with a hearty vote of thanks to the Chairman.

DAMAGE TO GAS AND WATER WORKS BY FLOODS.

It was scarcely to be supposed that gas-works would escape injury from the severe floods with which the country, especially the south-western portion, was visited last week. Indeed, situated as they usually are, in the lower parts of towns, or on canal or river banks, they are more likely than some other factories to suffer from climatic conditions such as those which have lately prevailed. As far as accounts have reached us, Bath seems to have come off very badly—half the city being under water on Thursday, and the flood being nearly 18 inches higher than was the destructive one of 1882. The effect of this abnormal state of affairs was that the gas-works were brought to a standstill. Desperate efforts were made to keep the fires going; and, up to a late hour on Wednesday night, hopes were entertained that this would be done. We learn from a local source that, by noon on the following day, the water was 2 feet high in the retort-houses. The supply of gas had been kept up by drawing upon the stock in the holders, with such additional quantity as could be made in one retort-house; but the rising of the water flooded the inlet and outlet pipes, and this put a stop to the service. The electric-light works suffered in like manner—several feet of water being in the basement. At night, the portion of the city usually lighted by gas was in darkness; and the resulting gloom may well be imagined. But the inhabitants had been prepared for this contingency—the Mayor having been apprised of the condition of affairs at both the gas and electric-light stations; and early in the day a notice was issued throughout the city that there would be no supply from these quarters, and calling upon the people to make the necessary provisions for their comfort. At a late hour the water was found to be receding; so that there was a prospect of a return to the ordinary condition of affairs. On Friday night, all the submerged houses in the city were free; but gas making, we understand, could not be resumed. Farther west, at Helston, the inundation was so serious at the gas-works that the fires were put out in the retort-house; and Monday night found the streets and houses of the town in darkness. When the water subsided later in the week, it was discovered that so much damage had been done to the manufacturing plant, that the supply of gas could not be renewed, and the town remained without light. It was hoped that the supply would be resumed on Saturday. At Okehampton, the gas-works were also flooded on Monday. But the damage done in this case was less serious; and the supply of gas was resumed late on Monday night. St. Ives was plunged into darkness from another cause. In this town water poured down the streets with such torrential force that the gas and water mains were washed out of the ground. The mischief was so serious that the gas supply could not be continued; and for two or three nights, while the floods continued, and until the mains could be relaid, the town was without gas. It is estimated that the damage will entail an expenditure of about £1000 for repairs. At Kingsbridge the water supply was stopped owing to the contamination by flood water. In South Wales a temporary bridge provided at Newbridge during the erection of a new bridge by the County Council over the River Ebbw, was washed away on Wednesday night, and water and gas mains slung across the bridge were carried away down the river. As a result, Abercarn was deprived of water, and a portion of the public thoroughfares were in darkness. On the South coast, at Lewes, the gas-works and offices were so much flooded, owing to the great quantity of water in the Ouse and the high spring tides meeting, that several times during the past week there was as much as 3 feet of water in the valve-house of the gasholders and in the underground vaults of the furnaces; while it was several inches deep even in the main flue under the retort-stack, and in the engine-room and exhauster-house. The Thames Valley suffered from the floods in a matter altogether unprecedented. Last Saturday morning, the Directors of the Windsor Gas Company announced that they would be unable to make gas; that the stock in hand would soon be exhausted; and that it was doubtful when they would be able to furnish a supply. Arrangements were promptly made by the Directors for lighting the public lamps with paraffin till the production of gas could be resumed. At the Castle, a large number of oil and paraffin lamps supplemented the gas that could be obtained; and oil-lamps were provided for the offices and platforms of the Great Western Railway Station. Fortunately, there has since been an abatement of the floods; and in recording the inconveniences attending them in the few cases mentioned above, it is gratifying to find that, as far as we can learn, they were unaccompanied by sacrifice of life.

Fire-Clay Goods for the Birmingham Gas-Works.—We learn that the tender of Bowens Limited Successors for fire-clay retorts, and bricks for regenerative retort-settings, has been accepted by the Birmingham Corporation Gas Department.

Sale of Shares.—Messrs. Alexander, Daniel, Selfe, and Co., sold by auction last Thursday, £11,000 of 7 per cent. maximum ordinary stock of the *Bristol Water Company*. The reserve price was £145 per £100. Four lots were sold at £146, 47 at £145 15s., 21 at £145 12s. 6d., and 38 at £145 10s.; the average being a little more than £145 13s. The gross amount realized by the sale was £17,021 7s. 6d.

INCREASED STOREAGE AT THE COLNE GAS-WORKS.

On Friday, the 9th inst., the members of the Gas Committee of the Colne and Marsden Local Board assembled at the gas-works, at Colne, to witness the starting of the new holder, which, with its tank, has been erected there by Messrs. C. and W. Walker. The company met at the office of the Board's Engineer and Manager (Mr. H. Simmonds, F.C.S.), where they were introduced to Mr. Alfred Featherstone, Messrs. Walker's General Manager. The inaugural ceremony was performed by the Chairman of the Gas Committee (Mr. J. Hartley) in the new governor-house, by opening the 18-inch valve on the outlet of the holder, which was formally declared ready for the supply of gas to the town. In the evening, a dinner took place at the Union Hotel. After the usual loyal toasts had been honoured, the Chairman (Mr. Hartley) referred to the growth of Colne during the past five years, and said the increased consumption of gas had been 52·5 per cent. Having spoken of the excellent way in which the new holder had been carried out, he proposed "Prosperity to the Contractors," and coupled the toast with the name of Mr. Featherstone. Mr. Featherstone, in reply, stated that the holder and tank were entirely of steel, and were constructed from the plans and specifications supplied by Mr. Simmonds. The tank was 100 feet in diameter, 25 feet deep, and stood 20 feet out of the ground. The holder was in three lifts, 98, 96, and 94 feet in diameter respectively; each 24 feet deep. The working capacity of the holder was 500,000 cubic feet. Mr. Catlow, J.P., Chairman of the Board, in proposing "The Gas Department," coupled with the toast the name of Mr. Simmonds. He said they were all well pleased with the work done by him. In the five years which had elapsed since his appointment, the whole of the works had been entirely remodelled on the most modern and soundest working principles; and the profits had increased considerably year by year. The retort-house was capable of making 750,000 cubic feet of gas per day; and during the past three years the average production per ton of Yorkshire coal had been 10,600 cubic feet of 18-candle gas. The coke sold was 10·2 cwt.; and the stoking, which was done by West's manual machines, came out at 2s. a ton, including boilers, exhausters, coke stacking, and coal wheeling. They hoped, however, to bring this figure down to 1s. 6d. when the whole of the house, consisting of twelve benches, was working. With regard to the rest of the plant, it was capable of dealing with 1¼ million cubic feet of gas per day; and, with the new holder just erected, the storeage capacity was a million cubic feet. Mr. Simmonds, in responding, gave a descriptive account of the growth of the gas-works from their formation in 1839.

RETFORD CORPORATION GAS AND WATER SUPPLY.

Annual Reports on the Gas and Water Undertakings.

At the Meeting of the Retford Town Council on the 9th inst., reports were presented by the Gas and Water Committees on the working of the undertakings in their charge for the year ending June 30 last. The Gas Committee stated that during this period the remaining old gasholder had been renewed and enlarged, at a cost of about £1420; and they expressed the opinion that the undertaking was now more complete and satisfactory than it had been since the Corporation acquired it about 16 years ago. The expenditure on capital account had been £197; but, against this, £23 had been received from the sale of cooking-stoves—leaving the net expenditure £174. Of this sum, £55 had been spent on the gasholder, and the rest in extending the mains and services. The gross profit for the year was £2684—the largest amount realized under the Corporation; and it resulted principally from the increased value of residuals, from greater economy exercised in the management of the works, and from a reduced expenditure on repairs. The net profit was £896, which, with the amount brought forward (£744), made the total standing to the credit of the net revenue account at the close of the year £1640. Out of this sum the Committee proposed to transfer £1000 to the credit of the capital account. In this way they believed that, with the amount they would be in a position to add next year, they would be able to pay for the new holder without increasing the amount borrowed. The Chairman of the Committee (Alderman Parker Tomlinson) moved the adoption of the report; and the motion was carried unanimously, with the general comment that the results recorded were of a highly gratifying nature. This is largely due to the careful oversight of the works by the Engineer and Manager (Mr. J. B. Fenwick). While referring to the gas undertaking, we may mention that a trial of incandescent gas-burners is to be made for street lighting. The report presented by the Chairman of the Water Committee (Alderman J. L. Plant) showed that the total amount borrowed for the purposes of the undertaking at the end of the past financial year was £21,500, whereof £6091 had been repaid—leaving £15,409 still owing. In the twelve months ending June 30 last, a sum of £280 was expended on works and mains. The water-rents amounted to £2127, as compared with £1973; the gross revenue being £1407, against £1339. The net profit was £191—about £90 more than in 1892–3; and the balance standing to the credit of the net revenue account at the close of the financial year was £316. Alderman Plant, in moving the adoption of the report, stated that the water-works were in a most efficient condition; that there was an abundant supply of water; that the income therefrom was greatly increasing; and that the Committee had no fault whatever to find. The report was unanimously adopted.

THE GAS WORKERS' UNION AND THE PLYMOUTH GAS COMPANY.

The General Secretary of the Gas Workers' Union (Mr. William Thorne) has received a letter from Mr. J. Thomas, the Secretary of the Plymouth Gas Company, in reply to the one sent to the Company on the 25th ult. (see *ante*, p. 884), asking for an investigation of the outrage recently committed at the gas-works. Mr. Thomas's communication is dated the 8th inst. He states therein that his Directors have not made any charge against the Union men in their employ, and that they cannot hold themselves responsible for any rumours which are being insidiously circulated in the town. They fully appreciate the anxiety of the Executive of the Union to discover the author of the attempted outrages at the gas-works; but they are decidedly of opinion that this object cannot be attained by any such inquiry as that suggested. Replying on the following day, Mr. Thorne briefly expressed his thanks to the Directors for their letter, and his regret at their decision.

A few days later, Mr. J. W. Gardner sent to a local newspaper a letter giving his version of the affair, from the Union standpoint. He calls attention to the fact that the first outrage was discovered on the day on which a petition had been presented to the Town Council on the subject of the emanation of noxious gases from the new works and he remarks upon the strangeness of the coincidence. He implies that the announcement of the discovery was made with the view of removing blame from the Company, and possibly condemning some innocent person. He points out that the offer of the reward of £100 by the Directors did not appear in the papers till the 19th ult.—four days after the outrage—leaving time for the culprit to escape; and he says that, by way of showing their desire to discover the guilty parties, they refused the assistance offered by the Executive of the Union, as they said they believed no good could come of the proposed inquiry. Dealing with the statement in Mr. Thomas's letter to the effect that no charge had been made against the Union men, Mr. Gardner acknowledges that this may be strictly correct; but he asks if the words used by the Chairman to the two discharged workmen Gilbert and Phillips—that the Company did not want men like them, who tried to harm a gasholder—did not amount to one. He also cites remarks by the Engineer and the Secretary, at interviews, to the effect that a conspiracy had been going on to damage the Company's property, to show that something very like a charge had been made. Further, if there was no accusation against Union men, why, he asks, were Gilbert and Phillips—two men against whom the Directors could not honestly, he says, level any charge—sent away? He thinks that, if for no other reasons than to prove the innocence or guiltiness of these men—one a very old servant—the Directors should have accepted an investigation. Mr. Gardner next refers to reports in circulation in the town as to unauthorized persons (not ordinary workmen) being found in the meter-house on the 20th and 21st ult.; and he asks if the Directors are aware of these reports, and, if so, why the matter is kept so close. He closes his letter by referring to a deputation of Union officials to the Directors in May, 1892, to discuss the subject of the work of the firemen and coal wheelers; and he asks if this meeting was of such a nature as to forbid the one asked for in the present case. He declares that, while the men have kept to the agreement then come to, the Directors have departed from it.

ELECTRIC LIGHTING NOTES.

The Swindon Local Board have resolved to apply for a Provisional Order to authorize them to lay down electric lighting works, and to light all the streets in the town, the aggregate length of which is about 20 miles.

On the 6th inst., Warren Upham, aged 17, suddenly met with his death from an electric shock at the Taunton Electric Light Works. At the Coroner's inquiry last Thursday, the jury returned a verdict of accidental death; but they added that "greater care should be taken to insulate those parts of machines and guards from which dangerous shocks may be received, and that a safer system of oiling the machines should be adopted if possible, also that the insulation stools should be larger."

The Mayor of Southport (Dr. Wood) signalized his re-election to the civic chair last Friday week by opening the electric-lighting works. The cost of the installation (which is not a large one) has been about £13,000. The generating station is near the gas-works at Crowlands, two miles from the centre of the town. The current is conveyed into the town at a pressure of 2000 volts, and, at six sub-stations, is transformed into a pressure of 100 volts. The installation is capable of supplying energy equivalent to 4200 8-candle power lamps; and the applications already made are equal to 4700 lamps. Consequently an extension of the plant is a thing of the near future.

According to the Mayor of Huddersfield (Alderman J. J. Brook), the supply of energy from the Corporation electric-lighting works is increasing "in a very satisfactory manner." The number of consumers connected in November, 1893, was 84; having lamps fixed equal to 6800-candle power. The number of consumers now connected is 199; having lamps fixed equivalent to 14,460-candle power, or representing an increase for the twelve months equivalent to 7660 8-candle power lamps. The generating plant was increased last December by the addition of an engine and alternator, capable of supplying 8000 8-candle power lamps. These were started early in January, and have been taking the heavy loads during the dark part of last and the present season. The Mayor states that the cost of generating electricity compares very favourably with other towns. The capital expenditure on the works and plant on Sept. 30 last was £45,120.

The nuisance caused by the Morecambe Electric Light and Power Company's works is becoming a serious matter for both the owners of property and residents in the neighbourhood. The Medical Officer of Health reports that the "trade" carried on in the Company's building is a "nuisance and injurious to the health of the inhabitants in the district;" and, on this report, the Local Board have directed the Surveyor "to make complaint before a justice, in order that the persons by whom the trade complained of is carried on may be summoned to appear before a Court of Summary Jurisdiction to inquire into the complaint, and to proceed therein according to the provisions of the statute in that case made and provided." At the meeting at which it was decided to take this step, it was stated by the Chairman of the Sanitary Committee that he had received a letter from an owner of property enclosing notices from tenants to leave two houses in the locality of the works.

In unveiling a tablet commemorating the opening of the electric

supply station of the Oldham Corporation a few days since, the Mayor Alderman Joseph Smith quoted the following figures (which may be useful for the purposes of comparison) as to the capital expenditure upon the various portions of the works: Land, including law charges, £2893; buildings, £5200; boilers, £991; economizer, £194; engines, dynamos, crane, and feed-pumps, &c., £5781; condenser, £308; switch-board, £706; batteries, £638; electrical instruments, £198; reservoir, £793; engineering, £450; street expenses, £78; printing, advertising, engineer's and sundry expenses, £256; street mains and services, £6372; and costs of obtaining the Provisional Order, £479, making a total (with shillings and pence) of £25,343. His worship also stated that the cost to them of each unit had been brought down from 1s. on Sept. 26 to under 6d. now, so that at the present time they were actually making a profit both on the expenses of administration and on the interest and redemption.

The electric lighting question occupied the attention of the Hertford Town Council at their meeting on the 9th inst. On the previous occasion, resolutions were passed adopting a scheme of electric lighting; but notice was afterwards given of a motion to rescind them. When the matter came up, a long discussion took place on a point of order; it being contended that the gentlemen who had signed the notice had done so before they were entitled to act. The notice was served on the 3rd, while their declaration of office was not made till the 5th of November. Eventually, the Town Clerk (Mr. T. J. Sworder) advised the Mayor to rule that the gentlemen in question were duly-elected councillors; and this was done. Alderman Willson then moved the rescinding of the resolution. He said he did so because it was carried by the casting vote of the Mayor, and not by a majority of the Council. He wrote stating that he was unable to be present at the previous meeting, but should have voted against the proposal had he been there. The Mayor had this letter before the meeting; and he (Mr. Willson) presumed that, in his zeal, he forgot to read it. An important matter like the one before them should have the support of a strong majority of the Council in its favour; and this it had not. For this reason, he moved the rescission of the resolution. Mr. Robinson seconded the motion, remarking that there was a strong opposition to the scheme on the part of the ratepayers. He could not understand how any man of business could be in favour of it. They were asked to risk £5000 or £10,000 to supply electricity at 6d. a unit, when, by incandescent burners they could get gas at 1d. a unit. Other speakers having expressed their dissatisfaction with the scheme—one saying it would involve a loss of £250 a year—the motion was carried by 11 votes to 8. Mr. Baker then moved that the Provisional Order obtained by the Corporation should be offered for sale forthwith, because the rejection of the scheme would, he said, have some effect on the estimates for the rates; and it might be possible to reduce them. The Council, however, adjourned without coming to a decision on this point.

THE WATER QUESTION AT TORQUAY.

Mr. C. Hawksley's Report.

Mr. C. Hawksley's report on the much-debated question of the purity and sufficiency of the water supply of Torquay came before the Town Council of that borough at the annual meeting on the 9th inst. In the course of a very brief discussion, Mr. Bunting said Mr. Hawksley had been called in to curse the people of Torquay and the Burgesses' Committee, but he had blessed them entirely; and they could do no better service to Torquay than by publishing his report. It was decided to refer it back to the Water Committee; the hope being expressed, however, that no further public discussion of the question would take place until next spring. Two questions were submitted to Mr. Hawksley for his consideration: (1) The quality and purity of the supply; and (2) additional storeage. Dealing with the latter question first, Mr. Hawksley says the Kennick and Tottiford reservoirs together contain 297 million gallons of water, which will maintain a supply of 1,600,000 gallons per day throughout such protracted periods of drought as those which occurred in 1870 and 1887. But, owing to the favourable formation of the valley in which the reservoirs are situated, enabling large quantities of water to be impounded by means of low and unusually short embankments, it is in this case possible, without overstepping the limits of reasonable economy, to impound a portion of those waters which are now lost by flowing away over the bye-washes during wet periods. The embankment of the Tottiford reservoir has already been twice raised; and it could not prudently be further increased in height. It is therefore to the Kennick reservoir that attention must be directed. The embankment of this reservoir is now only 35 feet in height, and 400 feet in length at the top. It would be practicable to raise this by 10 feet; and the cost would not exceed £15,000. The additional quantity of water thus impounded would be 170 million gallons. This would raise the total storeage to 467 million gallons, and increase the capability of supply by 200,000 gallons. The cost of obtaining this further supply would be considerably less than that of an additional reservoir either in the existing or in a neighbouring drainage area. The present estimated population of 46,400 is 3000 persons in excess of the number which the reservoirs are, at the present rate of consumption, capable of supplying throughout a period of maximum drought. By the year 1898, the population of the district of supply will have reached 48,300; and if the actual rate of consumption—viz., 37 gallons per head per day—is maintained, the reservoirs, as proposed to be enlarged, will be inadequate. Mr. Hawksley thinks the legitimate consumption should not exceed 25 or 30 gallons per head; and if waste is prevented, and the consumption brought within these limits, the present drainage area will suffice for a period of at least 26 years. If the consumption is not reduced, the Corporation should, he thinks, at once seek an additional source of supply, such as might be obtained by impounding the waters of the Trenchford Valley; in which case it would be more economical to increase the size of the reservoir to be constructed than to raise the level of Kennick reservoir. In investigating the question of the purity of the water, Mr. Hawksley had the assistance of Professor Dewar, F.R.S. The report says that the chemical composition of the water supplied to Torquay proves that the chief organic constituent is vegetable matter of peaty origin; and but for the possibility of zymotic disease being brought into the watershed, and the dejecta of patients suffering therefrom infecting the reservoirs with the specific organisms of typhoid or cholera, it must be considered a high class water. The absence of pathogenic microbes from the water way be ensured either by, first, the removal from the drainage area of all habitations, and the restriction of the use of the land to pasturage; or, secondly, by the combined effect of storeage and subsequent sand filtration. The purchase of the drainage area would enable the first of these methods to be carried into effect. On the other hand, filtration after storeage would, under properly regulated conditions, be effectual in removing any pathogenic organisms which might reach the reservoirs in consequence of zymotic disease occurring among the persons resident in the drainage area; but it would still be advisable to take precautions, as far as practicable, to remove the more objectionable sources of pollution occurring within the drainage area. As to the comparative cost of the two schemes, it is estimated that the purchase of the land of the drainage area would come to £27,000; while the cost of filters is put by Mr. Hawksley at £28,000 for 1,600,000 gallons a day, and £31,500 for 1,800,000 gallons daily. If only one of these is adopted, Mr. Hawksley says he should prefer filtration, which has, in addition to the removal of the pathogenic organisms, the advantage of removing from the water any particles of peaty and mineral matters in suspension, and thereby improving the general quality and appearance of the water. Having regard to all the circumstances, and to the alarm which has been created by the discussions which have taken place, and to the position of Torquay as a health resort, he considers it advisable that the drainage area should be acquired, and its use restricted to pasturage.

STOCKTON AND MIDDLESBROUGH WATER BOARD.

Half-Yearly Report.

The following report on the past six months' finances has been issued by the Stockton and Middlesbrough Water Board to the constituent Corporations:—

The accounts of the Water Board for the half year ending Aug. 13 last, show the capital expenditure for the half year to have been £44,951; bringing up the total cost of the undertaking to £1,696,813. Of the capital expenditure during the half year, the principal items are as follows: On account of Hury reservoir, £1098; Blackton reservoir, £6277; flood-water channel, £2588; conduits, 2, 3, and 4 (gravitation main), £27,780; Engineer's commission, £2000; and extension of supply-mains, £1659. The sums received on capital account during the half year amount to £19,542; bringing the total up to £1,689,380—being £6832 less than the amount expended. The revenue account shows the income to have been £32,581; being an increase of £908 as compared with the preceding half year, and £826 as compared with the half year ending Aug. 13, 1893, so that the loss of revenue from the Kirkleatham district has been more than balanced by increases in other directions. The expenditure on revenue account during the half year amounts to £8244; being a decrease of £191 as compared with the preceding half year, and of £461 as compared with the half year ending Aug. 13, 1893. The balance carried to net revenue account is £24,337, as compared with £23,238 in the previous half year, and £23,094 11s. 4d. in the half year ending Aug. 13, 1893. The net revenue account is debited with several payments on account of alteration of the engines at Broken Scar and other matters, and is credited with the interest allowed by the bank. After being dealt with in this manner, there remains a balance of £32,529, including the sum of £8807 brought forward from the previous half year. Of this amount £21,000 has been paid to the Corporations during the half year; leaving £11,529 carried forward at the end of the half year, £9000 of which has since been paid over to the Corporations. It is with great pleasure that the Board are able to reiterate the announcement made twelve months ago, that the works in Baldersdale and the mains, &c., in connection with them, are in such a forward state that, unless something at present quite unforeseen should occur, the new supply of water will be ready to be turned on some time before Christmas.

At the annual meeting of the Board yesterday week, Alderman Hugh Bell was unanimously re-elected Chairman for the nineteenth time; and, in thanking the members, he referred to the present position of the works. If the open weather continued, they would, he believed, before the end of the month, find the new undertaking was completed. They would have the whole of December left; so that the work would certainly be finished within the time required by statutory obligation.

Singapore Gas Company, Limited.—In the report of the Directors for the half year ending June 30 last, which will be presented to the proprietors at the extraordinary general meeting on the 29th inst., they state that the result of the half-year's working has again proved disappointing. This, they say, is chiefly due to the continued decline in the rate of exchange, which has averaged during the half year, on the remittances received, only 2s. 2d. per dollar; being the lowest rate since the Company's existence. The sales of products and profit on fittings show an increase; but this is absorbed by an almost corresponding decrease in the gas and meter rental. The accounts have been closely collected; and the Manager (Mr. H. W. Smith) reports that the works are in good order and repair. The Directors announce with pleasure that a contract for public lighting has been arranged with the Municipal Commissioners of Singapore, by which the Company will receive $3·20 per lamp per month, instead of $2·70 as previously. This contract will come into force from the 1st of January next. On the 1st of July last the Board also increased the price of gas to private consumers from $3 to $3·50 per 1000 cubic feet. These increases of price, both for public and private lighting, the Directors point out should considerably improve the position of the Company. The balance available for appropriation is £1057. This the Directors recommend should be carried to the profit and loss account.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Some ignorant or evil disposed person has set on foot a statement to the effect that trouble has been found in one of the towns in Scotland where the Peebles oil-gas process has been adopted, in consequence of service-pipes getting choked. Those who are acquainted with the Peebles system know that any such assertion is altogether untrue. A falsehood when it gets a start is always difficult to catch up; and the only way to get alongside of it, is to get on its track as soon as possible. This is what has been done by Mr. J. Gordon Mason, the Secretary of the Oil-Gas Enrichment Company, because as soon as the rumour reached his ears, he took means to ascertain the views upon the subject of the leading gas managers in Scotland who have adopted the process. A circular-letter was at once sent out to them asking if anything of the kind had occurred in their experience, or if they had had any other cause of complaint in connection with the process. Replies have been received from all of them; and in every case they have been favourable to the process. Mr. T. Whimster, of Perth, stated that he had received no complaint in connection with the oil gas; and that as to its condensing and choking service-pipes, he thought that was impossible in the Peebles process, if properly conducted. Mr. A. Scott, of Galashiels, wrote saying he could confidently state from experience that there was very little, if any, condensation with the oil gas; that they had over 4000 consumers, and had not had a single complaint, or seen the least trace of choked service-pipes; and that he could fearlessly assert that, with ordinary attention, the oil-gas process was a decided success. Mr. A. Yuill, of Alloa, said that they had not found condensing and choking up of the service-pipes; that they had on several occasions to open their main-pipes for making connections, and in every case they found the pipes perfectly clean and dry; and that from a practical experience of the Peebles process, extending over fourteen months, he had every reason to feel satisfied with it, both from a practical and financial point of view. Mr. G. Malam, of Dumfries, I presume, discovered the origin of the story. In his letter he stated that, in the beginning of the lighting season, he was troubled more than usual with some of the street-lamps choking up at the governors, caused by a deposit of naphthalene; that this had always been a yearly occurrence, but more so this year; that some of his Committee had expressed the view that it was due to the oil gas; that to settle the matter he wrote to several gentlemen on the subject; that the majority were of opinion that his trouble lay in carbonizing the coal (splint) at too high a heat; that since then he had proved that to be the case, and was now free from complaint; and that he was thoroughly satisfied with the process, and had always expressed the same opinion to anyone desiring information on the subject. These testimonies should satisfy everyone as to the unfounded nature of the rumour. Mr. Whimster says "if properly conducted," which is, of course, an important element. It is possible to send oil gas made by the Peebles process into the mains insufficiently condensed; but such a course is not likely to be followed, as it would not be profitable. There is another way in which condensation might take place in the gas-mains and service-pipes where oil gas is supplied; and that is, just as Mr. Malam found it, by condensation taking place from the coal gas with which the oil gas is mixed. In that case, however, it would not be the oil gas which would be at fault, but the coal gas. After this correspondence, it may be taken as certain that, if condensation is found, it will not be owing to the oil gas, but to something else.

As I expected, Mr. W. Ure, who was returned in absence, on account of illness, to the Glasgow Town Council, has been re-elected Convener of the Gas and Electric Lighting Committee of the Corporation. Mr. Ure's health, I am glad to say, is improving; and he is about to spend a holiday at Crieff, which, it is to be hoped, will bring back his strength, and so fit him for the arduous work of his responsible office during the winter. That there is work to be done, is shown by the fact that the Corporation have as yet only been able to secure coal, since the termination of the miners' strike, to the extent of 50,000 tons of the permanent stock of 200,000 tons which they usually keep.

Almost on the same subject, I may mention that on Tuesday a letter appeared in the *Glasgow Herald*, signed with the initials T. H., in which the writer makes the charge against the Glasgow Corporation Gas Committee that they are, in the matter of their coal contracts, adopting the policy which he says they formerly pursued, of beating down the price of coal to such an extent that it will be impossible for coal-masters to pay their miners a living wage. To that cause, the writer attributes the late strike—not, of course, confining himself to the Glasgow Corporation, but distributing the responsibility between them and the railway companies. The result of this beating down of prices, he says, was that contracts for more than half the output from all the mines were undertaken at prices of from 4s. 6d. to 5s. a ton at the pits. He asserts, regarding the Gas Committee, that "the old game of negotiating with each other has been commenced, placing one against another, and trying to beat down prices." If it is the intention of the Corporation to decline all contracts above last year's prices, he thinks that if the coalmasters give way to them there will be another long strike before very long. In England, he points out, the average price per ton at the pits is 8s. 6d., and the same in Germany; and he cannot understand how a Scotch Corporation should be determined to buy so very much cheaper. Well, without going into the ethics of the matter of a living wage, and without admitting that the writer's charge against the Gas Committee is true, for I have no information on the subject, I must say that, if the Committee are doing what he says they are, there is a good deal of justification for their action. The miners have just come out of a conflict in which they have been worsted in an endeavour to establish a living wage; and at present the coal trade is hampered by the fact that prices in Scotland are relatively higher than they are in England. It would therefore seem to be the natural conclusion that in the near future there must be a lowering of the prices for coal. As to whether the reduction is to come out of the profits of the coalowners or out of the wages of the men, I think there need be no doubt. Had the men been able to establish their contention in the late strike, it would have come out of the masters' pockets; but as they were not successful, it is the men who will suffer most.

It is almost a commentary upon the above subject that already the miners are being urged by their leaders to agitate for an increase of wages of 6d. per day. It is only the leaders who are taking this step; and it remains to be seen whether the men will "catch on." The general expectation is that they will not. Meantime the masters, it is already given out, are resolved to oppose the demand if the men should make it. The ground upon which the leaders make their claim for an advance of wages is that the masters are charging from 9d. to 1s. 6d. per ton more than they did before the strike, which means that they are pocketing higher profits. The masters' reply is that they are yet fulfilling contracts which were broken during the strike, and for which they are merely getting the old price; and that it is only the small quantity which they are able to dispose of after satisfying contracts for which they are getting the higher prices. Whether that be so or not, I know that there is a strong feeling of resentment in the community at the price of coal being so high as it is, which is an illustration of my contention that the general expectation is that prices should be lower than they were last year. On the whole matter, I should say that anyone who has a contract for coal to place should not be in a hurry to settle long contracts at high rates, but should wait a little, as easier prices are likely to be had soon.

At the Perth Gas Commission on Monday last, a letter from Mr. T. Whimster, the Manager, was read, in which he stated that the quantity of coal in the works at present was only 1000 tons, as compared with 3000 tons at this time last year. The decrease in the stock, Mr. Whimster said, was owing to the coal contractors being unable, during the time of the late strike, to send the full quantity of coal. He was of opinion that, unless there was a better service, there would be great risk at the beginning of the new year; and in the event of a short strike, the town would be in darkness. The Commissioners resolved to urge upon contractors to fulfil their engagements.

The Dalkeith Gas Company have, it is announced, resolved to increase the price of gas from 4s. to 4s. 2d. per 1000 cubic feet.

The Police Commissioners of Motherwell have this week unanimously resolved to apply for a Provisional Order to enable them to supply electricity for lighting. Towards this resolution they have been assisted by a report from Mr. Mavor, of Glasgow, out of which they have contrived to spell that they will get electric light without its becoming a burden upon the ratepayers, and that the cost would be about the same as they had been paying for gas. The Commissioners were urged, too, by Mr. Jack, the gentleman who moved the resolution to proceed, to go into the scheme, as it would be likely to have the effect of causing the Gas Company to reduce their charge for gas. In fact, this gentleman was quite enthusiastic over the subject; but I should say he was a most unsatisfactory leader to follow, for though one member of the Commission was anxious to have some information as to the cost, he could not get it. The Commissioners, if they are wise men, will, in going in for electric lighting, discount considerably Mr. Jack's jaunty views on the advantages they are to derive from it.

There has been another explosion in Glasgow in the culvert which carries the electric lighting mains. It took place at the corner of Jamaica and Argyle Streets—probably the very busiest part of the whole city; but being at half-past eleven at night there were few people about. An iron plate about two feet square, covering a manhole, was thrown into the air a distance of about five feet, and struck a young man on the knee. Another similar plate was lifted a few inches. Somebody took it off, leaving the opening unprotected; and a woman stepped into the hole, and was injured. The cause of these explosions is always put down to accumulations of gas in the culverts; but there is a mystery about the matter which no one seems capable of clearing up. A curious part of the incident is that, for about two minutes, the electric street lights in the vicinity went down, which would seem to point to the cause being with the electric current itself, unconnected with any other element.

In the First Division of the Court of Session yesterday a judgment of some importance to the administrators of special water supply districts was given. A special district was formed in 1873 in the parish of West Kilpatrick, in Dumbartonshire; and in 1886 the burgh of Clydebank was formed inside the special district. The question in dispute was as to the collection of the assessments for water. The Police Commissioners of the burgh of Clydebank maintained that they, as the Local Authority for public health purposes, were entitled to impose and levy the assessments upon the community in the burgh. The County Council of Dumbartonshire, on the other hand, maintained that they, as succeeding the Parochial Board of the parish, were entitled to impose and levy the assessments over the whole water supply district, including the burgh of Clydebank. The Court has given effect to the contention of the County Council. The Judges were of opinion that special water supply districts had been the subject of very special legislation; and that the true reading of the Public Health Act of 1867, the Local Government Act of 1889, and the General Police Act of 1892, was that where they found works, establishment, and rates in existence, it was natural that these should not be broken up and changed by municipal and police authorities. No machinery existed for the Police Commissioners being brought into action. If the Police Commissioners were to have the power to assess, they would do it on occupiers alone; whereas if the County Council were to have the power to assess, they would do it half on owners and half on occupiers, which, in their lordships' opinion, the Legislature intended should be done. The subject is of importance, in that there are a good few water districts in which there are burghs under the Police Acts; and this decision removes from the control of the Police Commissioners one of the most important departments of their administration. They will doubtless feel it to be a hardship to have a concurrent authority in their midst; but, on the other hand, it is almost a necessity that an undertaking like a water-works should be under the control of a single body, and not of two bodies who might not at all times be of one mind as to what was best to be done in such matters (say) as maintenance, repair, or extension.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Nov.* 17.

Sulphate of Ammonia.—There is a complete absence of orders; and, of course, this lack of demand at this time of the year, affects values unfavourably. This lack of business is remarkable, especially when it cannot be denied that requirements exist in all quarters. But the tendency since the beginning of the month has made consumers more than hopeful of covering their wants at very low prices; and the idea prevails that the longer they abstain, the more favourable will be their purchases. So far so good; but as the unforeseen generally happens, they may, by a risky action of this sort, eventually find themselves in a dilemma. Continental consumers especially may, in the event of a severe winter, find it impossible to get their supplies; and thus have their manufactures entirely interfered with. Prices are, of course, lower. But there is no excessive quantity pressing on the market; and as was the case last month, there may be a sharp rally, when parcels are really wanted. The quotations have been reduced to £12 per ton at shipping ports. At any rate this is the outside value according to buyers' ideas. Nitrate remains steady.

LONDON, *Nov.* 17.

Tar Products.—Benzols are dull for prompt and forward delivery. No better price is offering. Carbolic acids continue at reduced prices; and, notwithstanding the absence of stocks in makers' hands, and the fair inquiry that exists for them, there does not appear to be any immediate prospect of improved values. Anthracene is strong at Committee's rates—arising doubtless from the distinct improvement in the alizarine trade both at home and abroad, and the large increase in the use of alizarine blue in lieu of indigo; it being now admitted that the former dye is much faster than the latter. Pitch maintains its value both for prompt and forward delivery. The other products are without noticeable change; and the following prices have been paid during the week: Tar, 16s. 6d. to 21s. Pitch, prompt, 40s.; forward, 37s. 6d. Benzol, 90's, 1s. 2d.; 50's, 1s. 2d. Solvent naphtha, 1s. 3d. Toluol, 1s. 3d. Crude naphtha, 5½d. Creosote, liquid, 2¼d.; ordinary, 1¾d.; salts, 17s. Cresylic acid refined, 1s.; brown, 10d.; Carbolic acid, 1s. 4½d. Anthracene, "A," 1s. 1d.; "B," 10d.

Sulphate of Ammonia is entirely in the hands of "bear" operators, who have succeeded in again depressing values. Business during the week has taken place at £12 3s. 9d. to £12 5s., London; £12 to £12 5s., Hull and Scotch ports—less 3¼ per cent. Ammoniacal liquor is offered at 7s. to 10s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—There is certainly no improvement to report in the coal trade of this district; but, if anything, the position becomes rather worse. The exceptional mildness of the season so restricts the usual winter demand for house-fire coals, that the better qualities of round coal are becoming somewhat of a drug, notwithstanding pits are only in exceptional cases working more than four days per week; and there is so much cutting on the part of sellers anxious to get rid of surplus supplies, that prices are scarcely maintained where business of any weight is being done. As an illustration of the excessively low prices that have been taken to make clearances of anything like quantities, shipping orders for best coal have been taken at 10s. 6d. per ton, delivered at the ports on the Mersey, which means something like 8s. 9d. per ton at the pit mouth. Nominally, the quotations are 11s. to 11s. 6d. for best Wigan Arley; but even for inland trade it is only in isolated cases where business is being done at these figures. The average selling prices may be taken at about 10s. 6d. to 11s. for best Wigan Arley; 9s. 6d. to 10s. for Pemberton four-feet and seconds Arley; and 7s. 6d. to 8s. for common house coals at the pit mouth. The position with regard to the lower qualities of round coal for general manufacturing purposes is also quite as unsatisfactory. The depressed condition of the principal coal-using industries necessarily restricts requirements; and common round coal for steam and forge purposes can be readily bought at the pit mouth at 6s. 6d. to 7s., whilst for shipment it is being offered at 8s. to 8s. 6d., delivered at the ports on the Mersey—the minimum figure leaving not more than 6s. 3d. at the pit. Engine classes of fuel continue a glut upon the market, although perhaps the better qualities, owing to the limited demand for house-fire purposes, are, if anything, not quite so plentiful. At the pit, common Lancashire slack has been sold at as low as 3s. 3d. to 3s. 6d.; and the better sorts range, according to quality, up to 5s. to 5s. 6d. per ton, with common slack from other districts offering at the pit mouth at about 1s. 6d. to 2s. per ton. With regard to gas coal, it is, of course, at this time of the year only in isolated cases that contracts of any weight are being given out; but the Belfast Corporation have during the past week placed a contract for 60,000 tons of screened gas coal, and the excessively low price at which it has been taken is another illustration of the exceedingly depressed condition of the coal trade. This contract has usually been secured in Lancashire; and it was competed for by several Lancashire collieries, at prices averaging about 13s. per ton, delivered at Belfast. The contract has, however, been secured by a Yorkshire colliery, at a price which, it may be presumed, is under that quoted by the Lancashire owners; but even supposing the Yorkshire colliery has secured the contract at 13s. per ton, the coal which is being shipped at the Partington tips on the Manchester Ship Canal—and this is another particularly unpleasant feature to Lancashire owners in connection with the loss of the contract—would not leave 6s. per ton at the pit mouth in Yorkshire.

North-Eastern Coal Trade.—There is now more irregularity in the coal trade of the north-east; that of steam coals beginning to fall off to an extent sufficient to make some of the collieries work very short time, whilst the increasing demand for gas coals has caused the Durham collieries to work fuller time than they have been doing for a considerable period. Of course, the price of steam coals is weakened by the increased competition for the fewer orders that are in the market; and thus the best Northumbrian steam coals are now to be had at 9s. 9d. per ton f.o.b., though one or two collieries which have fairly full order books ask about 3d. per ton more. Second-class steam coals may be quoted at from 9s. 3d. to 9s. 6d., and steam small coals, which are necessarily produced in smaller quantities when the pits are idle, are quoted about 4s. 3d. to 4s. 6d. per ton. Gas coals are now in larger delivery on old contracts, though the full production is not yet quite attained; and as there is rather more competition with other coalfields, the tendency of prices is towards ease. The taking of several contracts by collieries outside the combination at prices slightly below its rate, has caused a little irritation amongst some of the parties to that combination, which may have some result in the future. Generally, the price quoted for best Durham gas coals varies from 7s. 3d. to 8s.; but a few small contracts have been made at prices slightly below that rate. The consumption of gas coals is now steadily maintained; but it does not increase as rapidly as it did. There is a growing demand for household coals; but that for manufacturing fuel is rather limited, and contracts for next year are likely to be at rates below those now running. Coke is fairly steady for local consumption; but there is only a moderate requirement for export. The prices generally quoted vary from 13s. to 14s. per ton f.o.b. Nothing seems to have been done yet as to the large contracts for gas coke for manufacturers for next year; but prices are unaltered.

Scotch Coal Trade.—A steady trade is being done; and prices are easier all round. On account of the approaching winter, sales to Baltic ports are falling off, which has led to less demand for ell. Splint is plentiful, and is being taken up rapidly. As evidence that the scarcity of stocks which existed at the close of the strike is being overcome, it may be mentioned that at some collieries, the owners are beginning to stack coal. With that so early begun, there should be in a few weeks, an over-abundance of coal on the market, with, necessarily lower prices. The quotations are: Main, 8s.; ell, 8s. 9d. to 9s.; splint, 9s.; and steam, 9s. per ton f.o.b. Glasgow. The shipments for the week amounted to 151,447 tons—an increase upon the quantity in the preceding week of 9487 tons, but a decrease compared with the corresponding week of last year of 48,684 tons. For the year to date, the shipments have amounted to 4,358,646 tons—a decrease upon the corresponding period of last year of 2,584,073 tons.

Torquay Gas Company.—With the object of considering the question of raising additional capital, an extraordinary general meeting of the shareholders of the Torquay Gas Company was held yesterday week. Mr. Kitson, the Chairman of the Company, said it was necessary to provide for the extensions now being carried out at the works, which include the erection of a large gasholder. The Directors recommended that they should be empowered to borrow or take up on mortgage the sum of £7500 authorized by the Torquay Gas Act, 1878. This amount was the whole of their remaining capital under old Acts; and the Directors thought it desirable, instead of issuing at present further shares under the new Act, to proceed to raise on loan the sum they were entitled to borrow. Considering the present value of money, there was every prospect of getting the loan on favourable terms. He moved to this effect; and it was agreed to.

The Rating of Mines for Public Lighting.—In the JOURNAL for Feb. 20 last (p. 352), we briefly reported the case of *Thursby and Another v. The Churchwardens and Overseers of the Parish of Briercliffe-with-Extwistle*, which raised, in the Court of Appeal, an important question as to the rating of mines for public lighting purposes. The matter came originally before the Divisional Court upon a special case arising on an appeal against a rate made under the Lighting and Watching Act of 1833. It stated that the appellants were colliery proprietors working coal mines in the respondents' township, and as such were rateable to the relief of the poor. The question was whether the mines were liable to be rated on the higher or the lower scale; in other words, whether the mines were to be regarded as "property" or "land." By the Act in question, the Overseers had the same powers for levying rates for the purposes of the Act as for levying rates for the relief of the poor, "provided always that owners and occupiers of houses, buildings, and property (other than land) rateable to the relief of the poor shall be rated at, and pay a rate in the pound, three times greater than that at which the owners and occupiers of land shall be rated at and pay for the purposes of this Act." The Divisional Court held that the coal mines were liable to be rated on the higher scale; and the Court of Appeal affirmed their decision. The case was taken to the House of Lords; and, at the conclusion of the arguments last Thursday, the decision of the Court of Appeal was unanimously upheld.

Claim for Compensation in Connection with the Launceston Water Supply.—Recently the Launceston Town Council obtained the sanction of the Local Government Board to a scheme for improving the water supply of the borough, by drawing upon a stream at Bray Down. The proposal has, however, given rise to a claim for compensation on the part of Mr. S. Pearn and Mr. J. Climo, the owner and occupier of a mill on the banks of the stream, whose water rights will be interfered with. The question has been submitted to the arbitration of Mr. F. W. Dymond, of Exeter, who has lately held an inquiry. Mr. Climo, the tenant, claimed £670 as compensation. This sum was made up of eleven years' rent at £30, £330; and two years' profit, £340. The case for the Corporation was that the claims were exorbitant. It was pointed out that, as the tenant has a lease which has eleven years to run, the owner will not sustain any immediate loss. The Corporation had offered him £250 compensation; and the Arbitrator was asked to say that this was sufficient. With regard to the tenant's claim, it was said that only a slight reduction would be made in the working power of the mill. Instead of 200,000 gallons, Launceston would only take about 100,000 gallons a day from the stream. Ample compensation would be the erection of a turbine, to cost £240. Mr. H. E. Duke, Barrister, appeared for the claimants; and the Town Clerk (Mr. C. H. Peter), for the Corporation. Among the witnesses for the claimants was Mr. R. H. Worth; while those for the Corporation included Mr. S. Jenkins, Engineer of the Launceston water scheme, and Mr. H. Frances, Manager of the Devonport Water-Works. The Arbitrator will make his award in due course.

Additional Water-Works for Portrush.—Mr. L. L. Macassey, of Belfast, has prepared a scheme for obtaining an auxiliary supply of water for Portrush. He proposes to utilize springs in the townlands of Killygreen Upper and Beardiville, which give in dry weather a combined flow of 50,000 gallons per day. The present storeage capacity, he says, could be slightly increased by excavating and deepening the existing reservoir at the upper end, and by raising the level of the embankment and overflow. In this way, the storeage of 7 million gallons would be increased to 9 millions. The quality of the water will not, he admits, be first class; but it will be equal to the present supply, and, with good filtration, it can be made safe and clear. The cost of the new works is estimated at £4800.

The Reconstruction of the St. Ives Gas-Works.—The Gas Committee reported to the St. Ives Town Council at their last meeting that three firms had tendered for the re-construction of the gas-works; and they recommended the acceptance of the offer of Messrs. Willey and Co., of Exeter, for carrying out the entire work for £1821. It would, they also stated, be necessary to apply for a Provisional Order and the sanction of the Local Government Board to the borrowing of £6000 for the extensions. Mr. Jenkyn, the Chairman of the Committee, moved the adoption of the report, and that the Town Clerk be instructed to make all necessary arrangements for procuring the Order, and to prepare specifications for carrying out the work. Mr. Daniell seconded the motion, and mentioned that Messrs. Willey and Co.'s tender was some hundreds of pounds lower than the other two. The Committee said they were convinced they had done the right thing in purchasing the works.

South Australian Gas Company.—In the twelve months ending June 30 last, the revenue of this Company from sale of gas, residuals, &c., amounted to £80,435, notwithstanding a reduction in the price charged in five of their districts for the greater part of the period. In their report, the Directors state that the receipts, though approximating those for 1892-3, would have exceeded them but for the falling off in the value of the residual products. The expenditure was £48,098. A larger amount than usual was laid out for wear and tear, for renewal of mains and the maintenance of works, and the payment of an increased dividend; yet the Directors are able to carry forward a sum of £11,179 of undivided profit. They have arranged to make a further reduction in price, as from the September quarter, to consumers in the suburbs of Adelaide supplied from the Brompton works; thus making the rates uniform with those charged in the city. At these works, the retort-houses are being enlarged, a new boiler has been fixed, and a large station meter is to be erected. During the past financial year, the final instalment was paid on the last issue of shares; so that the capital—£250,000—has now been all called up.

Failures of the Electric Light.—We learn from the *Electrical Review* that on the evening of the 31st ult., at half-past seven, all the districts (which would include about half Madrid) supplied with electric light by the Campania Madrilena were plunged in darkness, owing to the breaking down of one of the cables. Those theatres, including the Royal Opera House, which are served by the Company had, of course, to suspend their performances; and the general inconvenience was very great. Lighting was provisionally re-established at half-past eleven; the Company notifying that the usual service would be effected next day. On the previous evening, the upper part of High Street, Chelmsford, was thrown into darkness by the extinction of the electric light from a similar cause. Councillors are complaining of lamps being out at other times. On the following Friday evening, the electric light went out suddenly in all the public and private buildings and shops in Worcester, and was not restored for half an hour. At the meeting of the Watch Committee on the 9th inst., the Hon. A. P. Allsopp complained that the electric light supplied to private consumers, which was all that could be desired for the first fortnight, had since been abominable. On one occasion, it was impossible to read without the aid of candles. It was explained that the Brush Company were still engaged in perfecting the machinery, and that this accounted for the fluctuation in the pressure.

The Assessment of the Stourbridge Gas-Works.—A special meeting of the Stourbridge Improvement Commissioners was held on Monday of last week, to consider the question of appealing against the new assessment of the gas-works at Amblecote, and the gas-mains in the various parishes in the Union. The Chairman (Mr. C. H. Collis) intimated that what the members had to discuss were the grounds on which they should lodge the appeal. Mr. Haskew, a member of the Assessment Committee, thought the proper course would be for the Commissioners to appear before the Committee, and state where they thought they were over-assessed, or on what grounds they appealed. If no satisfactory settlement could be come to, then would be the time to ask for further powers. Another member of the Assessment Committee (Mr. Worthington) was sure that body would be disposed to meet the Commissioners in a friendly way, and would not wish to impose more than a fair assessment on the gas-works. After further discussion, the Chairman said that, on referring to the resolution passed at the monthly meeting, he considered it empowered the Clerk to engage professional assistance in regard to the appeal without any further powers being added. Mr. Pargeter thought it would be time enough to think of appealing to Quarter Sessions after they had met the Assessment Committee. There had been assessments of the other gas-works in the Union, and of the railways and water-works; but he could not see why public undertakings should be selected for special treatment by the Assessment Committee. The public undertakings in the Union were last valued in 1882; and he was annoyed that the Guardians had not the courage to complete their work then, by having a valuation of the whole Union. The Chairman considered it unfair that public bodies should be assessed up to the hilt, while other property was under-assessed; and Mr. W. Jones said he was told of properties where thousands had been expended, and which were most inadequately assessed. He thought there should be a reassessment of the whole Union, whatever the cost might be. Ultimately a resolution was passed, defining the resolution passed at the last monthly meeting as empowering the Clerk to expend money in obtaining evidence to carry the appeal against the gas-works assessment before the Assessment Committee.

A Dispute in Connection with a Prepayment Meter.—At the Hanley County Court last Wednesday, his Honour Judge Jordan had before him a case in which James Claney, a boot dealer, sued the British Gaslight Company for 9s. 1d., money paid to them under protest. The case for the plaintiff was that he rented from the Company, and was supplied by them with gas through, a penny-in-the-slot gas-meter. When the meter was inspected by the Company's officer, it was found that it had registered a consumption of gas to the value of 16s.; while the amount of money in the meter was 6s. 11d. The Company thereupon demanded payment of the difference—9s. 1d.—which, to prevent the supply of gas being cut off, he was compelled to pay under protest. He contended that he had paid through the slot for all the gas he had consumed, and brought his action to recover the sum paid under protest. For the defence, it was stated that the meter had been tested and found to be in good working order. As it registered the consumption of 16s. worth of gas, while the money in the meter was only 6s. 11d., the plaintiff, in whose custody the meter was, was clearly liable for the difference. His Honour said he had never heard of these meters before; but, if they were no more reliable than he understood the penny-in-the-slot weighing and sweetmeat machines were, they were not very successful. Mr. Ashwell (who represented the Company) said the registering apparatus was quite correct; and the money must have been put into the machine before the gas could be obtained. His Honour: That raises a very serious issue. You do not charge the plaintiff with stealing the money? Mr. Ashwell said they did not go so far as that; but they contended that there ought to have been 16s. in the meter, and it was not there. In reply to his Honour, the plaintiff said that he had no key to the meter, and had not taken any money from it. The Gas Manager (Mr. J. Young) explained the working of the meter, and said that a penny must have been put in for every 25 feet of gas consumed. The index showed a consumption of 16s. worth of gas; and, that sum not being there, they insisted on the plaintiff paying the amount that was short. His Honour said it was clear from the evidence that plaintiff had had 16s. worth of gas; and he must pay for it. He therefore gave judgment for the Company.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 968.)

Issue.	Share	When ex-Dividend	Dividend on last Accts.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	11 Oct.	10½	Alliance & Dublin 10 p. c.	10	19—20	..	5 5 0
100,000	10	,,	7⅞	Do. 7 p. c.	10	13—14	..	5 7 2
300,000	100	2 July	5	Australian (Sydney) 5 % Deb.	100	105—107	..	4 13 4
220,000	5	14 Nov.	6⅝	Bombay, Limited	5	6—6⅛*	..	5 0 0
40,000	5	,,	6½	Do. New	4	4¼—4⅜*	+⅛	5 9 6
380,000	Stck.	15 Aug.	11½	Brentford Consolidated	100	230—235	..	4 17 10
180,000	,,	,,	8½	Do. New	100	180—185	+3	4 11 10
220,000	Stck.	28 Sept.	11	Brighton & Hove Original	100	215—220	+2	5 0 0
888,500	Stck.	30 Aug.	5	Bristol	100	115—120	..	4 3 4
320,000	20	28 Sept.	11½	British	20	48½—49½	..	4 10 10
50,000	10	30 Aug.	11½	Bromley, Ordinary 10 p. c.	10	11½—22½	..	5 2 2
51,510	10	,,	8½	Do. 7 p. c.	10	16½—17½	..	4 17 2
328,750	10	14 Nov.	2	Buenos Ayres (New) Limited	10	6¾—7*	..	2 17 1
200,000	100	2 July	6	Do. 6 p. c. Deb.	100	101—103	..	5 15 5
150,000	20	12 July	8	Cagliari, Limited	20	25¼—26½	..	6 0 8
550,000	Stck.	11 Oct.	13	Commercial, Old Stock	100	267—272	..	4 15 7
165,000	,,	,,	10	Do. New do.	100	195—200	..	5 0 0
160,762	,,	14 June	4½	Do. 4½ p c. Deb. do.	100	132—137	..	3 5 8
800,000	Stck.	14 June	13	Continental Union Limited	100	242—247	..	5 5 3
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	210—215	..	4 13 0
535,000	Stck.	30 Aug.	5	Crystal Palace Ord. 5 p.c. Stk.	100	115—120	..	4 3 4
486,090	10	27 July	11	European, Limited	10	22½—23½	..	4 13 7
354,060	10	,,	11	Do. Partly paid	7	16—17	..	4 17 1
5,646,590	Stck.	15 Aug.	12	Gaslight & Coke, A, Ordinary	100‡	248—252	..	4 15 3
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	105—110	..	3 12 9
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	277—282	..	3 10 10
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	130—135	..	3 14 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	200—205	..	3 13 2
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	180—185	..	3 15 8
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	275—280	..	3 11 5
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	165—170	..	3 10 7
1,061,150	,,	14 June	4	Do. 4 p. c. Deb. Stk.	100	127—130	..	3 1 6
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	132—137	..	3 5 8
908,000	,,	,,	6	Do. 6 p. c. do	100	180—185	..	3 4 10
3,800,000	Stck.	14 Nov.	12	Imperial Continental	100	225—230*	+1	5 4 4
75,000	5	14 June	6	Malta & Mediterranean, Ltd.	5	5—5⅛	..	5 9 1
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p. c. Deb.	100	109—111	..	4 10 1
541,920	20	14 Nov.	5	Monte Video, Limited	20	15—16*	..	6 5 0
150,000	5	30 May	8	Oriental, Limited	5	6⅞—7⅛	−⅛	5 6 8
60,000	5	13 Sept.	7	Ottoman, Limited	5	4¼—4½	..	7 7 4
166,870	10	31 Jan.	2	Pará Limited	10	1½—2	..	10 0 0
480,000	100	2 Nov.		People's Gas of Chicago—1st Mtg. Bds.	100	100—105	..	5 14 3
500,000	100	1 June	6	2nd Do.	100	98—103	..	5 16 6
150,000	10	11 Oct.	6	San Paulo, Limited	10	9—9½	..	6 6 4
500,000	Stck.	30 Aug.	15½	South Metropolitan, A Stock	100	335—340	+2	4 11 2
1,350,000	,,	,,	12	Do. B do.	100	282—287	+2	4 3 7
260,000	,,	,,	3	Do. C do.	100	290—295	+2	4 8 1
750,000	,,	12 July	5	Do. 5 p. c. Deb. Stk.	100	156—161	..	3 2 2
60,000	Stck.	30 Aug.	11½	Tottenham & Edm'nton, "A"	100	220—225	..	5 2 2
				WATER COMPANIES.				
746,011	Stck.	28 June	10	Chelsea, Ordinary	100	288—293	..	3 8 3
1,719,514	Stck.	11 Oct.	8	East London, Ordinary	100	230—235	..	3 8 1
634,740	,,	28 June	4½	Do. 4½ p. c. Deb. Stk.	100	150—154	..	2 18 5
700,000	50	14 June	8½	Grand Junction	50	120—124	..	3 8 7
708,000	Stck.	15 Aug.	12	Kent	100	302—307	..	3 18 2
1,043,800	100	28 June	9½	Lambeth, 10 p. c. max.	100	270—274	+1½	3 9 4
406,200	100	,,	7½	Do. 7½ p. c. max.	100	209—214	..	3 10 1
350,000	Stck.	28 Sept.	4	Do. 4 p. c. Deb. Stk.	100	132—135	..	2 19 3
500,000	100	15 Aug.	12½	New River, New Shares	100	384—388	..	3 2 6
1,000,000	Stck.	27 July	4	Do. 4 p. c. Deb. Stk	100	140—145	..	2 15 2
902,300	Stck.	14 June	6	S'thwk & V'xhall, 10 p. c. max.	100	168—173	..	3 9 5
126,500	100	,,	6	Do. D 7½ p. c. do.	100	157—162	..	3 14 1
1,155,066	Stck.	14 June	10	West Middlesex	100	278—283	+1	3 10 7

*Ex div.

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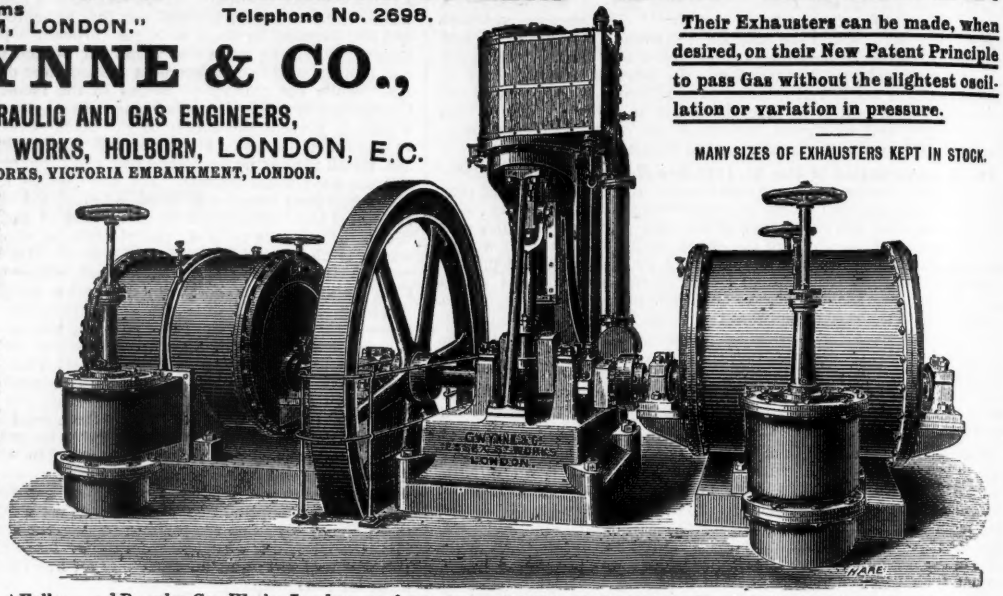

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*** See Advertisement p. 958 of this week's issue.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock Oldham."

SPECIAL PAINT FOR GAS-WORKS.

JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS, MANCHESTER.
Telegrams: "ENAMEL." National Telephone 1759.
GAS PLANT CEMENT
FOR ALL LEAKAGES.

PATENTS FOR INVENTIONS.

J. C. CHAPMAN, M.I.M.E. and Fel. Chartered Inst. Patent Agents. ADVICE ON ALL MATTERS CONNECTED WITH ABOVE.
Information and Handbook on application.
70, CHANCERY LANE, LONDON, W.C.

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, Leeds, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

SADLER AND CO., LIMITED,
MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

ALWAYS a Buyer of Spent Oxide, Tar, and AMMONIACAL LIQUOR.
Apply to J. HARDMAN, Milton, STAFFORDSHIRE.

GAS PURIFICATION.

OXIDE OF IRON BOG ORE.

BALE & CO.'S Oxide of uniform quality
Sample and Price on application.
OXIDE PAINTS, OILS, SULPHURIC ACID, &c.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore.
Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for, Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and adroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER LINCOLN."

BOG ORE.

WE are Importers of a first-class quality of this ORE, and wish to treat with Buyers.
C. E. MULLER AND CO.
Middlesbrough, November, 1894.

REDHILL GAS-WORKS ASSESSMENT APPEAL.

THE Report of the Proceedings at the hearing of the APPEAL of the REDHILL GAS COMPANY against the RATING OF THEIR PROPERTY in Reigate and Nutfield which was published in the JOURNAL has been now reprinted in Pamphlet form; and copies can be obtained, on application to the PUBLISHER, *price 4d. each.*

NOTICES FOR POSTING IN GAS-WORKS.

CARDS suitable for Exhibiting in Gas- Works, directing Officers and Workmen to REPORT all ACCIDENTS witnessed by them, together with the Clause of the "NOTICE OF ACCIDENTS ACT, 1894," specifying the notice required to be sent to the Board of Trade, can be obtained, *price 4d. each, or 2s. 6d. per dozen, post free.*
Section 4 of the "CONSPIRACY AND PROTECTION OF PROPERTY ACT, 1875," has been similarly printed. It is required, under a Penalty of FIVE POUNDS, that a Copy of the Section shall be posted up at all Gas-Works, in a conspicuous place, where the same may be conveniently read by persons employed thereat. Copies, in large type, on broad sheets (22½ inches by 17½ inches) may be obtained of WALTER KING, 11, Bolt Court, FLEET STREET, E.C. *Price 2s. per dozen; 10s. 6d. per* 100. On Cards the same size as those relating to the "Notice of Accidents Act," *price 4d. each or 2s. 6d. per dozen.*

GAS-FITTER.

WANTED, a competent Workman in Compo., Iron, and the General Fitting on a Gas-Works. Must be steady.
Apply, stating wages required, enclosing copies (only) of testimonials, to S. BARE, Gas-Works, GODALMING.

WANTED, a Situation as Meter InSPECTOR or CLERK. Age 25 years. Ten years' experience in a Provincial Gas-Works.
Apply, by letter, to No. 2446, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

AS Secretary and Accountant, or Assistant. Advertiser desires engagement in either capacity. Fifteen years' secretarial experience. Good address. Excellent testimonials as to business qualifications.
Address No. 2456, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ADVERTISER (age 35) seeks Situation as MANAGER or FOREMAN of Gas-Works. Twenty years thorough practical experience. No objection to go abroad. Speaks Spanish, and has excellent testimonials for past management.
Address No. 2453, care of Mr. King 11, Bolt Court, FLEET STREET, E.C.

WANTED, a steady Man as Gas-Fitter. Must be married, and over 28 years of age. One used to Gas Company's work preferred.
Apply, with testimonials, and stating salary required, to ROBERT BEYNON, Torquay Gas-Works, Hollacombe, Paignton, DEVON.

WANTED, two good Stokers by a Suburban Gas Company. Must be used to Boiler, Engine, and Exhauster. Wages 30s. per week. Constant work found for steady men.
Apply, by letter, with references, to No. 2455, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Railway Tank Truck, to hold not less than 2000 gallons. Must be in Perfectly sound condition.
State lowest price to No. 2452, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, Two Second-Hand Purifiers, Eight feet square, with Four-Way Valves complete.
Address reply, stating price, to BROWN BROS. AND CO., Rosebank Iron-Works, EDINBURGH.

FOR SALE—Two Second-Hand Purifiers, 6 ft. by 3 ft.; and one Seven TWIN PIPE CONDENSER.
Address H. R. MAYNARD, Gas-Works, Lydd, KENT.

FOR SALE, cheap—A quite new Gas-holder, 45 feet diameter by 14 feet deep.
For further particulars, apply, by letter, to No. 2454, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TEN-HORSE Power "Trusty" Gas-ENGINE, by Weyman, FOR SALE. Cost £220 two years ago. Will be sold for half-price, to clear at once. Guaranteed in good working order.
Apply to W. BIRCH, HIGH WYCOMBE.

CORPORATION OF LEICESTER.

CAST-IRON PIPE CONTRACT.

THE Gas Committee of the above Corporation are prepared to receive TENDERS for the supply and delivery of the necessary CAST-IRON PIPES and CONNECTIONS, from 2 inches to 24 inches in diameter, required during the Twelve Months ending the 31st of December, 1895.
Specification and Form of Tender to be obtained from the Engineer.
Tenders, addressed to Alderman Lennard, Chairman, and endorsed "Tender for Cast-Iron Pipes, &c.," to be delivered at these Offices not later than Eleven o'clock m., on Saturday, Dec. 8, 1894.
The Committee do not bind themselves to accept the lowest or any tender.

ALFRED COLSON, M.Inst.C.E.,
Engineer and Manager.
Gas Offices, Millstone Lane, Leicester,
Nov. 13, 1894.

CORPORATION OF LEICESTER.

RETORTS AND FIRE-BRICKS.

THE Gas Committee of the above Corporation are prepared to receive TENDERS for the supply and delivery of RETORTS and FIRE-BRICKS.
Specification, Quantities, and Form of Tender can be obtained from the Engineer.
Tenders, addressed to Alderman Lennard, Chairman, and endorsed "Tender for Retorts, &c.," to be delivered at these Offices not later than Eleven o'clock a.m., on Saturday, Dec. 8, 1894.
The Committee do not bind themselves to accept the lowest or any tender.

ALFRED COLSON, M.Inst.C.E.,
Engineer and Manager.
Gas Offices, Millstone Lane, Leicester,
Nov. 13, 1894.

SOUTH METROPOLITAN GAS COMPANY.

SALE BY TENDER OF £25,000 FIVE PER CENT. PERPETUAL DEBENTURE STOCK.
MINIMUM PRICE £157 PER CENT.

NOTICE is Hereby Given, that it is the intention of the Directors of this Company to SELL BY TENDER £25,000 of 5 per Cent. PERPETUAL DEBENTURE STOCK, in accordance with the Provisions of the South Metropolitan Gas Act, 1882.
Particulars of same, with Form of Tender, can be obtained at this Office on application to the undersigned; and tenders must be sent in on or before Tuesday, the 18th day of December next.
The Stock will be allotted to the highest bidders; but no tender will be accepted at a lower price than at the rate of £157 money for each £100 Debenture Stock.

By order,
FRANK BUSH, Secretary.
Office: 709A, Old Kent Road, S.E.,
Nov. 16, 1894.

TO TAR DISTILLERS.

THE Directors of the Shotley Bridge and Consett District Gas Company invite TENDERS for the purchase of the TAR produced at their Works for the Year 1895.
Quantity, about 60,000 gallons.
Contractor to provide Barrels, and accept delivery at Consett and Blackhill Station.
Tenders to be sent to the undersigned not later than Dec. 6.

M. RICHLEY,
Secretary.
Nov. 9, 1894.

RETORTS AND FIRE-BRICKS.

THE Directors of the Rochester, Chatham, and Strood Gaslight Company are prepared to receive TENDERS for the supply of about 1500 feet run of CLAY RETORTS, 43,000 FIRE BRICKS, 200 TILES, and 50 tons of CLAY.
Specification and Form of Tender may be obtained from the undersigned, to whom tenders, endorsed "Retorts, &c.," must be delivered on or before Noon, of Thursday, the 13th of December, 1894.

J. M. VEEVERS,
Engineer and Secretary.
Gas Offices: 58, High Street, Rochester,
Nov. 15, 1894.

EAST LONDON WATER-WORKS COMPANY.

ISSUE OF £100,000 3 PER CENT. DEBENTURE STOCK. MINIMUM PRICE, PAR.

NOTICE is Hereby Given, that the Directors are prepared to receive TENDERS for the above Issue (being the First portion of the £500,000 DEBENTURE STOCK, created under the East London Water-Works Company's Act of 1894), bearing Interest at 3 per cent. per annum, less income-tax, and redeemable after the expiration of 25 years from the date of issue, subject to six months' notice being given by the Company. Minimum price, par.
Tenders must be delivered at the Company's Offices, St. Helen's Place, Bishopsgate Street, E.C., not later than Eleven a.m., on Thursday, the 13th day of December ensuing.
Particulars and Conditions, together with Form of Tender, may be obtained at the said Offices, or will be forwarded on application.

By order of the Court of Directors,
I. A. CROOKENDEN,
Secretary.
St. Helen's Place,
Bishopsgate Street, E.C.,
Nov. 15, 1894.

NOTICE.

IN THE HIGH COURT OF JUSTICE,
CHANCERY DIVISION,
MR. JUSTICE ROMER.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED,
v.
HIRSCHFELD and Others.

BY Injunction this day granted—the Defendants their Servants or Agents were restrained from Infringement of the Letters Patent granted to Carl Auer von Welsbach and Oliver Imray for Inventions in Incandescent Gas Lighting which Letters Patent are now the property of the Plaintiff Company and His Lordship granted a certificate that the validity of the Plaintiff's Patents was established.

FAITHFUL AND OWEN,
11, Victoria Street,
Westminster,
(Plaintiffs' Solicitors).
Nov. 2, 1894.

HARCOURT'S COLOUR TEST.

For Carbon Bisulphide, Sulphuretted Hydrogen, and Carbonic Acid in Coal Gas.

The Materials for the above Tests may be obtained from

Mr. S. E. MILLER, 115, Cowley Road, Oxford.

HOLMSIDE GAS COALS.
(Wrought out of Holmside and South Moor Collieries.)

PRESENT production 4000 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16¼ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of nearly

600,000 Tons per Annum.

Full particulars on application to
MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-ON-TYNE.

HUNTER'S
OXIDE OF IRON.
JAMES HUNTER, MINER, AND SHIPPER OF
NATURAL IRISH BOG ORE.
This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.
Samples and Prices on application.
11, BAY STREET, PORT GLASGOW.
Telegrams: "HUNTER, PORT GLASGOW."
Established 1872.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

THE
STOVE FOR 1894-5.

THE KING OF STOVES
A SANITARY GAS-STOVE

Requires no Flue.
Guaranteed free from Smell and Fumes.

ADVANTAGES:—

1. Freedom from smell or fumes.
2. Great heating capacity.
3. Absolute safety. Can be placed on a carpet or near a wall. Recommended by Fire Insurance Companies.
4. Requires no flue; hence can be placed in any part of a room.
5. Heat under perfect control.
6. Absolute cleanliness.
7. Cheerful in appearance.

SUITABLE FOR

SHOPS, HALLS, OFFICES, CLUBS, SITTING ROOMS, BEDROOMS, LIBRARIES, BATH-ROOMS AND ALL DOMESTIC PURPOSES, ALSO FOR CHURCHES, CHAPELS, MISSION-ROOMS, ETC

Send for Price List and Trade Terms to Manufacturers—

BROWN, MICHEL, & PAGE, Ltd.,
53, New Oxford Street, London, W.C.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cubic feet.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.
8 Lombard Street, NEWCASTLE-ON-TYNE.

W. RICHARDSON, Fitter.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton . .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Crystal Palace District Gas Company, Bombay Gas Company, San Paulo Gas Company, Ipswich Gaslight Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY, LIMITED,
Newcastle-on-Tyne.
W. H. PARKINSON, FITTER.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE
BOGHEAD CANNEL.

Yield of Gas per ton . . . . . 13,155 cub. ft.
Illuminating Power . . . . . 38·22 candles.
Coke per ton . . . . . 1,301·68 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,
COAL OWNERS, NEWCASTLE-ON-TYNE;
OR
E. FOSTER & CO.,
21, JOHN STREET, ADELPHI, LONDON, W.C.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD
BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

SULPHATE OF AMMONIA SATURATORS.

JOSEPH TAYLOR & CO.,
Central Plumbing Works, Town Hall Square, BOLTON.

Practical Makers of all kinds of Saturators, and Specialists in every description of Lead Work required in connection with Sulphate Plants.

Special attention to Repairs.

Seven Saturators placed with us the present Year.

HIGHEST REFERENCES ON APPLICATION.

LONDONDERRY GAS COALS

FROM THE
MARQUIS OF LONDONDERRY'S COLLIERIES,
COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

PIPES, 2-in. to 8-in. PIPES, 2-in. to 8-in. PIPES.

MONIER-WILLIAMS & Co.
IRONFOUNDERS,
MIDDLESBROUGH.

T. B. KITTEL, SHEFFIELD.
CONTRACTS FOR SUPPLIES OF ANY OF THE PRINCIPAL
ENGLISH & SCOTCH CANNELS.
REAL SILKSTONE GAS COAL
ANALYSIS AND PRICES ON APPLICATION.
T. B. KITTEL, SHEFFIELD.

COKE BREAKERS,

PRICES REDUCED.
(THOMAS & SOMERVILLE'S PATENT.)
New Design, with two Cutting Rollers, making less Breeze than their old pattern.

GEORGE WALLER & CO.,
PARK STREET, SOUTHWARK, E.C.,
And at STROUD, GLOUCESTERSHIRE.

THOMAS TURTON AND SONS, LIMITED,

SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS, TOOLS GENERALLY.
London Office:
80, CANNON STREET, E.C.

THORNLEY GAS COALS

WORKED BY THE
WEARDALE IRON AND COAL COMPANY, Ld.
OUT OF THEIR
THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. Pattinson, Public Analysts for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a Working Analysis made of these Coals by the Tudhoe and Sunderland Bridge Gas Company:—

[COPY.]
TUDHOE AND SUNDERLAND BRIDGE GAS COMPANY.
Tudhoe Gas-Works,
Spennymoor,
8th June, 1893.

Messrs. The
WEARDALE IRON & COAL COMPANY, LTD.

GENTLEMEN,

For the last two months we have used your **THORNLEY GAS COAL** exclusively at these gas-works; and I have pleasure in herewith giving you the actual results obtained during the trial.

Yield of Gas per ton: 10,300 cubic feet.
Yield of Coke: 13½ cwt.
Illuminating Power of Gas, average of a series of tests, **17 Sperm Candles.**
The Coke was of excellent quality.
The following is a complete ultimate Analysis of the Coal.

	Per Cent.
Carbon	83·128
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100·00

I am, Gentlemen,
Yours truly,
A. B. COWAN,
Manager.

For Price, &c., apply to the
WEARDALE IRON & COAL Co., Ld.
QUAYSIDE, NEWCASTLE-ON-TYNE.

COKE BREAKERS.

C. R. Mather & Son, Engineers, Wellingborough

THE SILICA FIRE-BRICK COMPANY,

OUGHTIBRIDGE, near SHEFFIELD,

MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY

FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY.

Strongly recommended where EXCESSIVE HEATS have to be maintained.

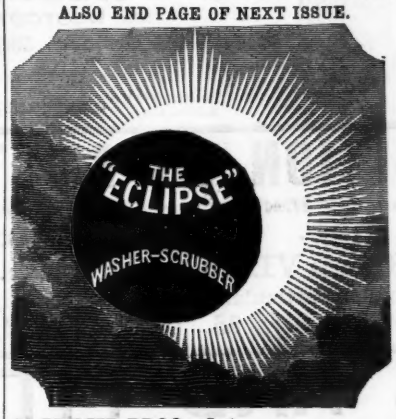
HEATHCOTE GAS COAL.

Rich in Illuminating Power & Yield of Gas.
Above the average in Weight & Quality of Coke.
Maintains a High Standard in Residuals.

THE GRASSMOOR Co., Ld.,

CHESTERFIELD.

SEE ADVT., p. 900 OF JOURNAL FOR NOV. 6,
ALSO END PAGE OF NEXT ISSUE.



CLAPHAM BROS., Ld., Keighley, Yorks.

TROTTER, HAINES, & CORBETT,

Brettell's Estate

FIRE-CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Proprietors of

BEST GLASSHOUSE POT & CRUCIBLE CLAY.

SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

ROBERT MARSHALL,

CANNEL COAL MERCHANT,

97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on Application.

CAST-IRON PIPES

FOR GAS AND WATER.

Pipes, One to Six Inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.

VALVES

FOR GAS, WATER, AND STEAM.

TELEGRAMS: "PIPES GLASGOW."

WM. MACLEOD & CO.,

56, ROBERTSON STREET, GLASGOW.

MOBBERLEY & PERRY

STOURBRIDGE.

Manufacture & supply best quality of

Gas Retorts (SEGMENTAL, HORIZONTAL, or INCLINED.)

Special Bricks & Blocks for GENERATOR & REGENERATOR FURNACES.

FIRE BRICKS, LUMPS, & TILES, BLUE STAFFORDSHIRE VITRIFIED BRICKS FOR PAVING, &c. &c.

EVERY REQUISITE FOR GAS-WORKS. Retort Setters sent to any part of the Kingdom.

Contractors for the erection of Retort-Benches complete.

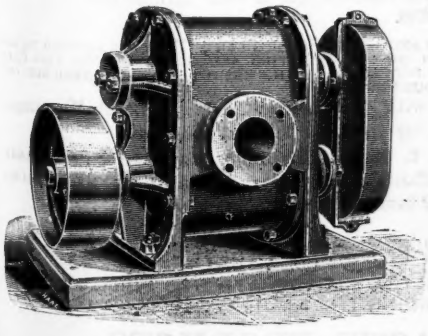
JOHNSON'S PATENT

DRUM PUMP AND GAS EXHAUSTER.

The Pump of the future for quickly and economically moving large bodies of Water, Semi-Fluids, &c.

The force of the Piston Pump with the capacity of the Centrifugal combined.

NO SLIDES OR FRICTIONAL WORKING PARTS.



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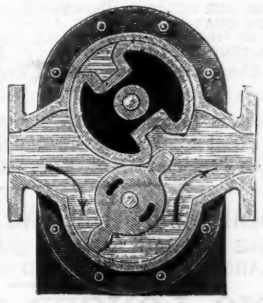

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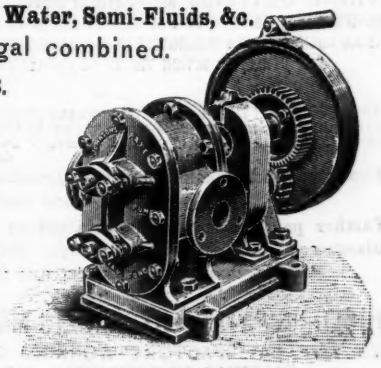


As supplied to H.R.H. the Prince of Wales for Pumping Gas Liquor at his Sandringham Gas-Works.

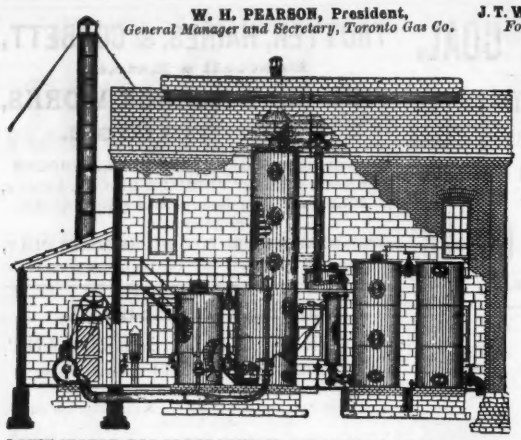
DRUM ENGINEERING COMPANY,

Hydraulic and Pneumatic Engineers, 55, ATHOL ROAD, BRADFORD.

W. H. PEARSON, President,
General Manager and Secretary, Toronto Gas Co.

J. T. WESTCOTT, M.E., General Manager & Treasurer,
Formerly Engineer for the United Gas Improvement Company, U.S.A.

L. L. MERRIFIELD, Chief Engineer,
Formerly Engineer for the United Gas Improvement Company, U.S.A.



LOWE WATER-GAS APPARATUS, Merrifield-Westcott-Pearson Setting.

THE

Economical Gas Apparatus Construction Co., Ld.

ENGINEERS AND BUILDERS
OF THE
IMPROVED LOWE

CARBURETTED WATER-GAS PLANT

Designed to give the greatest efficiency when using any kind of Oil, Gas-House Coke, Oven Coke, or Anthracite Coal.

MR. WESTCOTT MAY BE CONSULTED AT THE
LONDON OFFICES: SUFFOLK HOUSE, LAURENCE POUNTNEY HILL, E.C.

Canada and U.S.A. Offices: TORONTO.

Telegraphic Addresses: "COATESLEE, LONDON." "ECONWEST, TORONTO.

WORLDS EXHIBITION AT AMSTERDAM, 1895

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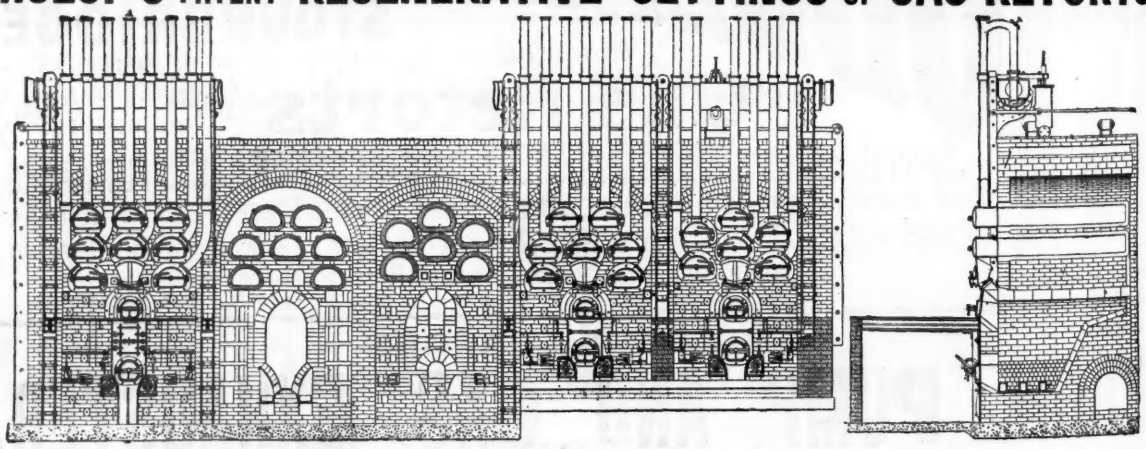

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Further particulars may be obtained on application to the Patentee's Agents: C. M. HAMILTON, 5, Stuart Street, Shawlands, Glasgow; J. E. FISHER, Stourbridge; JOHN WALSH & SONS, Retort Builders, Halifax, Yorkshire; RICHARD TURNER, Retort Builder, Denton, Lancashire; and from the Principal Agent, R. F. HISLOP (son of Patentee), Gas-Works, Paisley, N.B.

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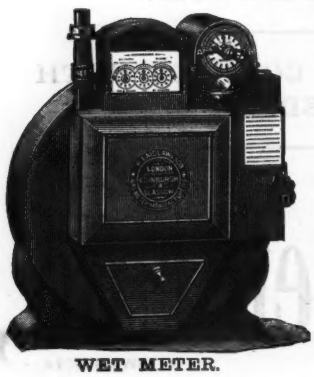
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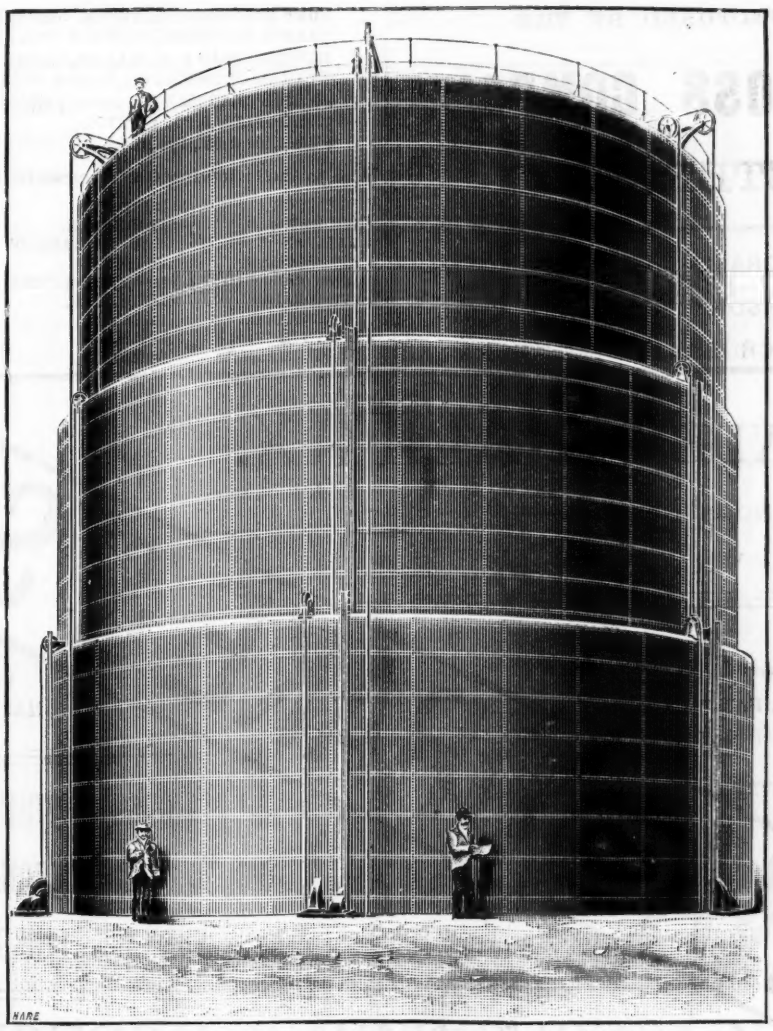

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[See also Advt., p. 964.

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